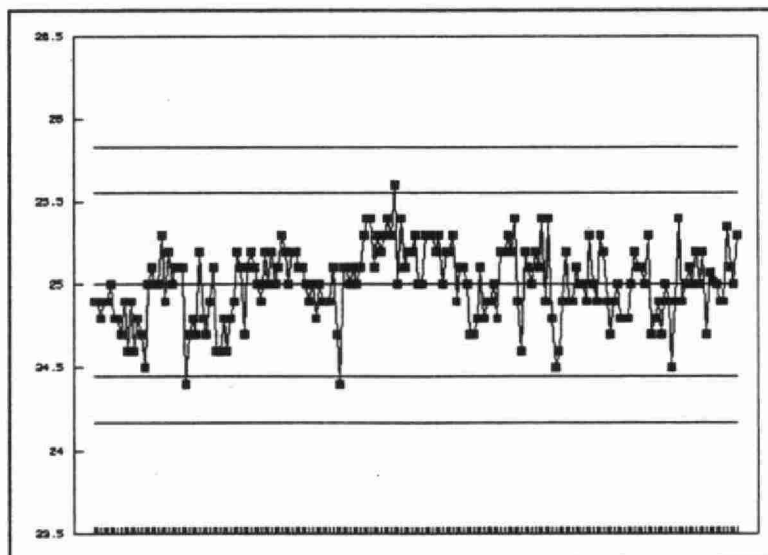


1992

Performance Report

Thunder Bay Laboratory



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Ministry of Environment and Energy
October 28, 1993

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SUMMARY

The Ontario Ministry of Environment and Energy Thunder Bay Laboratory provides analytical support for environmental programs in the Northern Region of Ontario. The laboratory performs chemical and microbiological analyses on a wide range of sample types.

The laboratory strives to maintain a high standard of analytical performance through its quality assurance (QA) program, of which quality control (QC) is an important component. The purpose of this report is to summarize the QC data for parameters routinely analyzed in water samples at the Thunder Bay Laboratory. It summarizes types of controls used for a test, the frequency of the controls, and the actual results of controls for the 1992 calendar year. The report is intended as a source of information for the laboratory community and for clients interested in the QC program at the laboratory.

ACKNOWLEDGEMENTS

The hard work and commitment to quality of all the Thunder Bay Laboratory staff is gratefully acknowledged. A special thank you to Lillian Delski and Cheryl McLeod for assistance in this endeavour.

Thank you, also, to the Water Quality Section of Laboratory Services Branch, Etobicoke, whose 1990 report provided the basis for this report.

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- Calcium
- Magnesium
- Sodium
- Potassium

Boron

Mercury

Hydrides

- Arsenic
- Selenium
- Antimony

1.0 INTRODUCTION

1.1 Internal Quality Control

The purpose of quality control samples is to demonstrate to the operator and data user that the analytical system is in control, and that the data is not affected by the analytical system itself. By monitoring these samples over the long-term, limits of effective performance can be established. By visualizing the performance of the instrument against these limits graphically, deviations from past performance can be easily identified and corrected before affecting data quality.

1.2 External Quality Control

An important aspect of a laboratory quality assurance program is the use of external agencies and standards. The laboratory is a member of the Canadian Association for Environmental Analytical Laboratories (CAEAL/ACLAE Inc.). Member laboratories can apply for certification/accreditation of tests. Parameters that are certified/accredited are noted in the report.

The Thunder Bay Laboratory also uses external reference materials, wherever possible, to check in-house standards (e.g., reference materials/samples from the United States Environmental Protection Agency or USEPA).

The Thunder Bay Laboratory actively participates in interlaboratory studies. Interlaboratory studies in which the laboratory regularly participates include:

LRTAP	Long Range Transport of Air Pollutants; Environment Canada; samples sent three times per year.
CAEAL	Canadian Association for Environmental Analytical Laboratories; performance evaluation samples sent twice per year.
GLAP	Great Lakes Action Plan; Environment Canada; samples sent twice per year.
MOEE	Ontario Ministry of Environment and Energy; performance audit samples are sent by the Quality Management Office routinely; special interlaboratory studies are periodically set-up; also referred to as "QM Blind Audits" through-out report.

Results of interlaboratory studies, or any information regarding this report, can be obtained by contacting C. M. Cotter at (807)475-1763.

2.0 GLOSSARY

Each parameter's performance report consists of a summary of the test method, followed by a sheet of tabulated data and a plot which summarizes the performance of the test. Although the same general format is used throughout the report, there may be slight differences in the format, reflecting the differences in the type of testing done in each section. Listed below is a glossary of terms which will aid in the interpretation of the summaries. A separate section on quality controls used in microbiology is included in the appropriate section.

Analytical Procedure:	Description of the analytical test procedure.
Blank:	Sample prepared in the same manner as field samples, but in which the analyte is known to be absent. Tests for background levels of the analyte in the analytical system.
Calibration:	The determination of the relationship between analyte concentration and instrument response.
Calibration Check Solution:	Standards prepared separately from the calibration solutions to ensure proper operation of the instrument and verify the current calibration. Also used as a in-run check to determine calibration drift during analysis.
Control Chart:	Relates ongoing analytical performance to control limits.
Control Limits:	Limits defined statistically or based on protocol requirements which, when exceeded, trigger analyst intervention.
Digested Spikes:	Blanks to which a know amount of analyte is added. These samples are taken through the analytical process to monitor analyte recovery. By comparison to control limits determined from historical data, establishes the validity of the current analytical run.
Drift:	Control samples to check for drift and/or sensitivity change.

Duplicates: Used to determine ability of the analytical system including the operator to repeat an analysis. Establishes the precision that can be expected from the analytical system. Low level duplicate data is used to statistically determine the detection limit of the system.

Interlabs: Studies that involve the exchange of samples amongst laboratories. The results are reported to the referee agency and compared to the median result generated by the participating laboratories. Provides a snapshot comparison to laboratories conducting similar analyses.

Instrumentation: Type of instrument used to perform the test.

LIS Test Name Code: Laboratory Information System (LIS) code for analysis requested.

Method Code: Quality Management Unit Code for the analytical method.

Method Introduced: Date current method was implemented at laboratory.

Modifications: Describes modifications to the test since the method was introduced, or provides historical information about the test.

Reference Materials: Purchased samples containing an known amount of analyte. The reference value is established through round-robin testing or through analysis by several independent analytical techniques. Represents an independent test of the accuracy of an analytical method.

Reporting: The maximum significant figures used to report the result. The calculated W and T values for that parameter. W and T are low level data qualifiers assigned to results that are at or near the detection limit.

Sampling:	Describes the container and preservative (if applicable) that is to be used for sampling and any special instructions required to ensure the integrity of the test.
Sample Preparation:	Sample preparation techniques which must be performed at the laboratory before analysis.
Sample Type/Matrix:	Sample types that can be routed to the workstation.
Section:	Section responsible for test.
Standard Deviation:	An estimate of the spread of repeated measurements about their average value, obtained under specified conditions.
S _w :	Standard deviation based on within-lab repeatability data which is used in setting warning and control limits.
<T:	A low-level data qualifier used to indicate that the measured value is a trace amount. Data qualified with <T should be interpreted with caution.
Units:	Unit of measurement in which results are reported.
<W:	A low-level data qualifier which indicates that no measureable responses were observed under the test conditions. The numerical value indicates the smallest amount that could have been measured under routine conditions. W is derived from the standard deviation of duplicates near zero.
Work Station Code:	LIS code for sample routing to the workstation.

3.0 MICROBIOLOGY

3.1 QUALITY CONTROL PROGRAM

In this report, data is presented which summarizes quality control (Q.C.) procedures used in the membrane filtration test and Presence/Absence test. These QC procedures are used to ensure that an analytical test is working properly and that reported results are accurate and reproducible within the limits of normal statistical variation.

MEMBRANE FILTRATION TEST (MF)

Duplicate Analyses

Duplicate analyses are conducted on average $\geq 5\%$ of the samples. The data are accumulated for each parameter and differences in duplicate results are sorted according to ranges of colony counts per filter. A mean and within-run standard deviation are calculated, where the standard deviation gives a measure of the repeatability of results.

The mean difference within each range is multiplied by 3.267 to give a precision criteria (PRC) for a particular range. The PRC is based on the previous 12 months of data. Graphs for each range of colony counts per filter show how 1992 results compare to the calculated PRC. If excessive bias is suspected, the results will not be reported.

Blank Control Filters

Each sample analyzed by the membrane filter test is separated from the previous sample by introducing a control filter at the beginning of each analysis. The control filter is employed in the same manner as those filters used for sample analyses, however, only sterile buffered rinse water is filtered. The control filter is placed on the least selective medium being used at the time. If any bacteria appear on the control filter, they were likely carried over from the previous sample. If there is only one target growing on the control filter and/or a few background colonies, the control filter is considered positive for growth but the next sample result is not deemed to be compromised. However, if excessive contamination is suspected, the next result will not be reported and, if possible, the analyses will be repeated.

Media Quality Control

A number of checks are made both during and after the preparation of a batch of medium. The pH of a medium is monitored after sterilization has taken place. The final pH may vary within specified limits from the recommended value. The medium is checked for sterility by incubating random samples of either tubes or plates (depending on how the medium is dispensed) at room temperature. Any bacterial growth will require retesting of the

medium for sterility. Confirmation of contamination will result in the rejection of the medium for any further use. The batch or lot number of a medium is recorded to determine if any changes in quality occur when batch or lot numbers change.

Differential agar media used in the detection and enumeration of indicator bacteria are tested to ensure their proper functioning. The medium is streaked or filtered with both a known target organism or positive culture and a known non-target organism or negative culture. If the medium is functioning properly, growth of the target organism will be abundant after 24 to 48 hours and will show typical colony morphology. Growth of the non-target organism will not occur or will be minimal. The results of all such tests are recorded and any deviations from the expected results will require retesting or rejection of the medium.

A quantitative QC test of agar media for membrane filter tests involves making up dilute suspensions of the positive cultures. Selected dilutions of these suspensions are filtered in duplicate and respective filters are placed on agar plates from the new and previous batch of medium. The number of colonies on the two plates should be approximately the same. Media is retested and rejected if it fails to meet the past performance of the previous medium. Alternatively, the cultures can be filtered on selective and non-selective medium. The culture should form approximately the same number of colonies on the selective and non-selective plates.

PRESENCE-ABSENCE (P-A) TESTS

Blank Control P-A Bottles

Every 20 samples, a blank control is prepared by pouring 100 mL of sterile distilled water into a P-A bottle and incubating it along with the regular P-A bottles. The P-A blank bottle is incubated for four days and should remain free of any bacterial growth or colour change. Isolation of indicator organisms in more than one P-A blank control test will require rechecking the sterility of the dilution blanks and P-A medium.

Media Quality Control

A number of checks are performed on the P-A broth including: pH, sterility at 20°C and 35°C and growth reaction of Escherichia coli, a fecal streptococcus and Salmonella typhimurium. If the medium is functioning properly, E. coli will produce a strong acid reaction (yellow colour in the medium) and gas reaction. The fecal streptococcus will produce an acid reaction only and S. typhimurium will produce heavy growth only.

3.2

Microbiology Performance Summaries

Escherichia coli

IDENTIFICATION:

LIS Test Name Code:	ECMF	Method Introduced:	1983
Work Station Code:	TBMF	Units:	Counts/100 mL
Method Code:	E6019A	Section:	Microbiology

SAMPLE TYPE/MATRIX: Surface and Waste Waters

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and/or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the surface of mTEC-IG agar and incubated for 23+/-1 h at 44.5+/-0.2°C. The temperature is gradually elevated by placing 2 plastic jars containing ice (50 mL of water) in the plastic container (one at each end of the container). The maximum number of target colonies per filter for counting purposes is 100.

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank filter between each sample.
Duplicate samples on $\geq 5\%$ of samples.

Media QC: Comparison of target counts on an old vs. a new batch.

Reporting: Results are qualified by "A" (for approximate) if the number of target colonies/filter is low and a small volume was filtered, or if the plate is overcrowded.

If the number of target organisms exceeds the upper counting limit of 100, the result is reported as:
 $>(\frac{100 \times 100}{\text{mL filtered}})$

If there is no recovery of target organisms, the result is reported as: $<(\frac{1 \times 100}{\text{mL filtered}})$

Escherichia coli

CONTROLS AND QUALITY ASSURANCE (Cont'd):

External QC E. coli quality control culture (lot #121589) from
Check: the USEPA.

MODIFICATIONS:

Before 1983, E. coli was detected using a 2-step urease procedure.

Escherichia coli – ECMF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 100 Counts/Filter

Control Filters:

	Number of Data	No. Positive	Data Affected
Blanks	635	1	None

Duplicates:

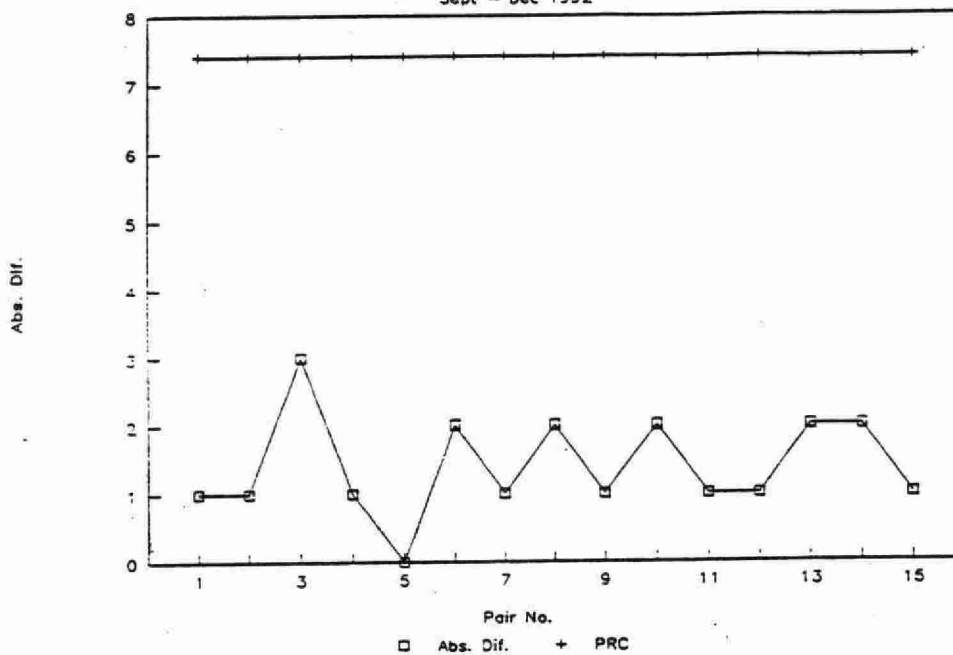
Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
61	0	20	1.9	1.6
15	21	80	4.5	3.5
0	81	100	–	–

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
12	12	12	12	None

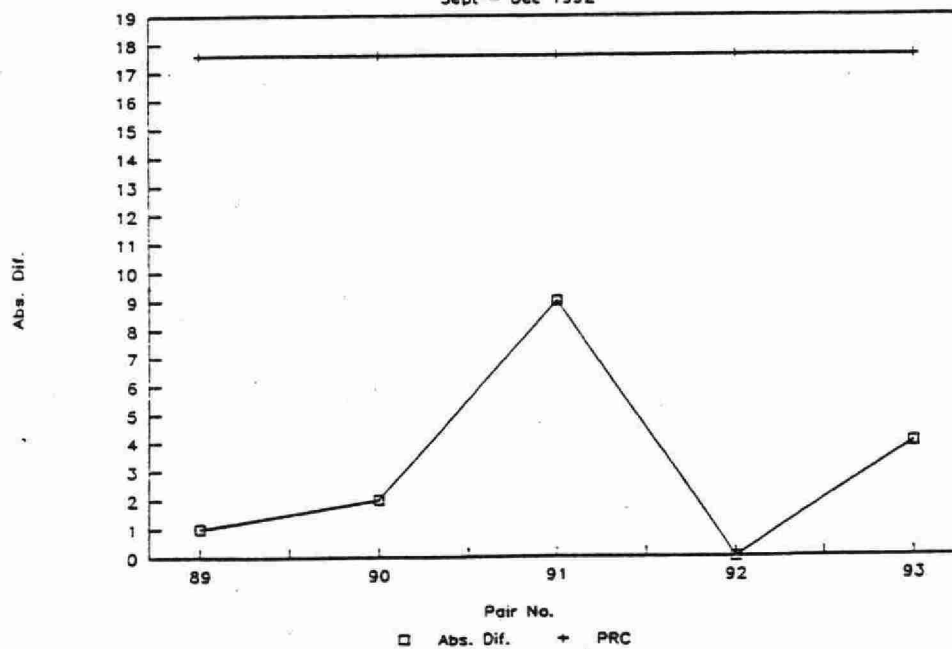
E. coli; 0-20 Range

Sept - Dec 1992



E. coli; 21-80 Range

Sept - Dec 1992



FECAL COLIFORMS

IDENTIFICATION:

LIS Test Name Code:	FCMF	Method Introduced:	1978
Work Station Code:	TBMF	Units:	Counts/100 mL
Method Code:	E6018A	Section:	Microbiology

SAMPLE TYPE/MATRIX: Surface, Waste and Drinking Waters

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and/or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the surface of mTEC agar and incubated for 23+/-1 h at 44.5+/-0.2°C. The temperature is gradually elevated by placing 2 plastic jars containing ice (50 mL of water) into the plastic container (one at each end of the container). The maximum number of target colonies per filter for counting purposes is 100.

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank filter between each sample.
Duplicate samples on $\geq 5\%$ of samples.

Media QC: Target organism count on selective vs. non-selective medium.
Comparison of target counts on an old vs. a new batch.

Reporting: Results are qualified by "A" (for approximate) if the number of target colonies/filter is low and a small volume was filtered, or if the plate is overcrowded.

If the number of target organisms exceeds the upper counting limit of 100, the result is reported as:
$$> \frac{(100 \times 100)}{\text{mL filtered.}}$$

FECAL COLIFORMS

CONTROLS AND QUALITY ASSURANCE (Cont'd):

Reporting: If there is no recovery of target organisms, the result is reported as:
 $< \frac{1 \times 100}{\text{mL filtered.}}$

External QC Checks: mTEC was tested with an E. coli quality control culture (lot #121589) from the USEPA.

Participated in an Ontario Ministry of Health Interlaboratory Study in 1991.

CAEAL certified.

MODIFICATIONS:

Before 1978, fecal coliforms were detected using m FC medium.

Fecal Coliforms – FCMF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 100 Counts/Filter

Control Filters:

	Number of Data	No. Positive	Data Affected
Blanks	2432	4	None

Duplicates:

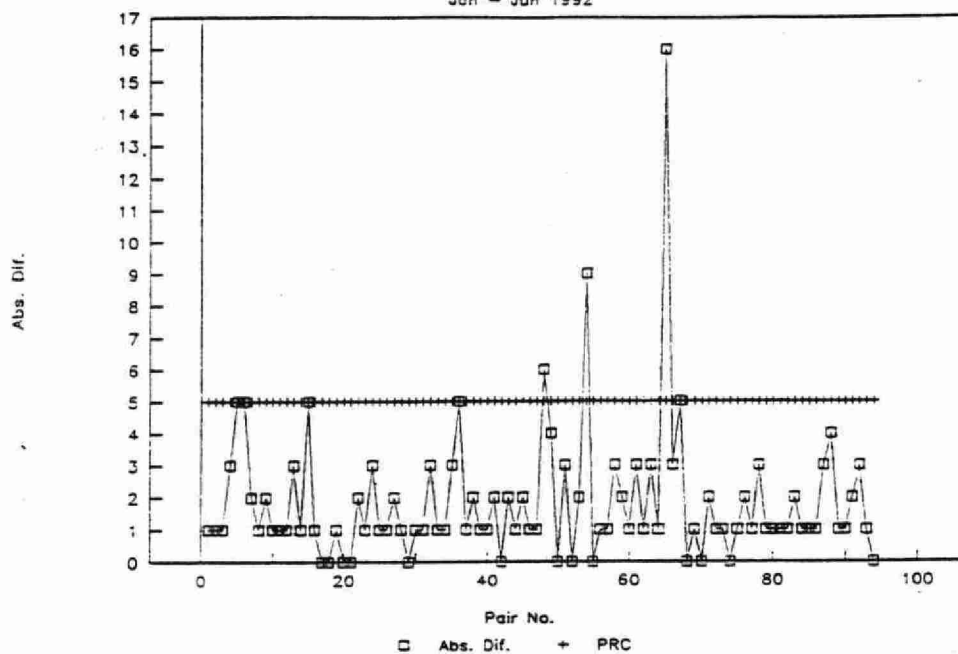
Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
207	0	20	1.6	1.8
22	21	80	5.9	5.7
0	81	100	–	–

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
14	14	14	14	None

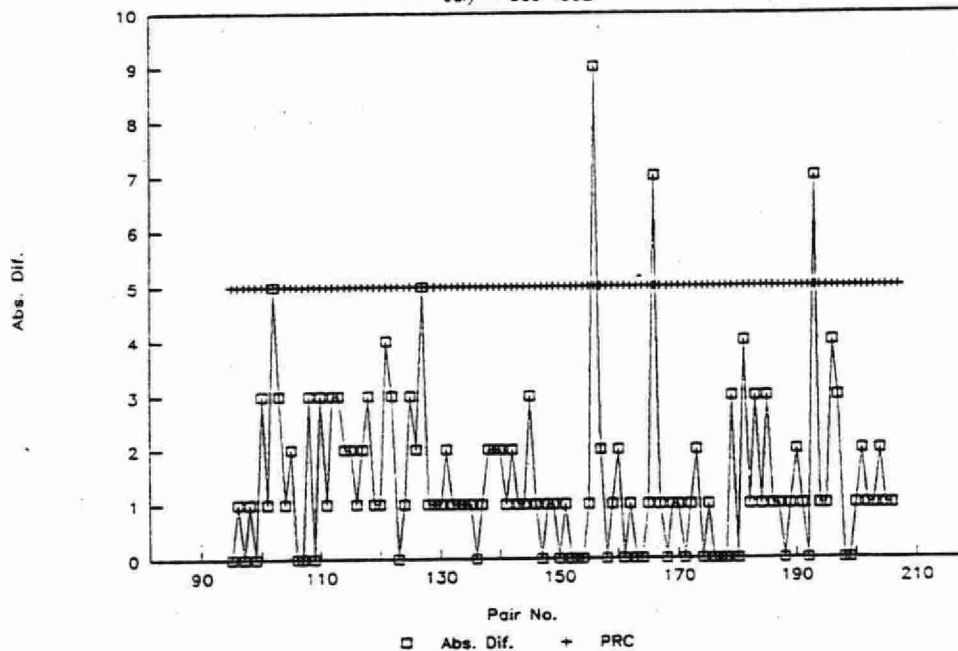
Fecal Coliforms; 0-20

Jan - Jun 1992



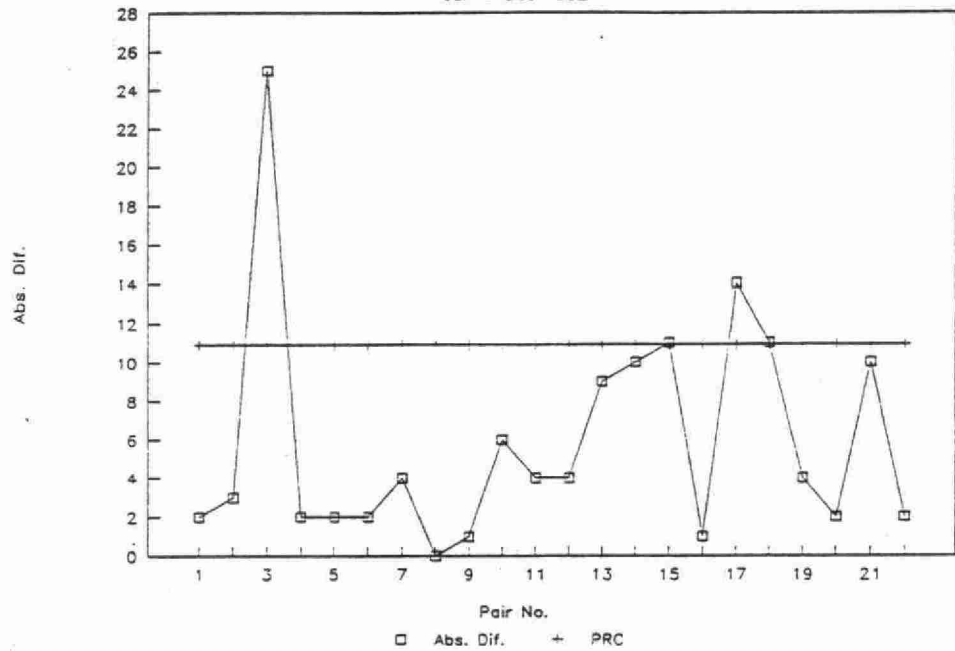
Fecal Coliforms; 0-20

July - Dec 1992



Fecal Coliforms; 21-80 Range

Jan - Dec 1992



FECAL STREPTOCOCCUS

IDENTIFICATION:

LIS Test Name Code: FSMF Method Introduced: 1968
Work Station Code: TBMF Units: Counts/100 mL
Method Code: E6017A Section: Microbiology

SAMPLE TYPE/MATRIX: Surface and waste waters

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and/or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the the surface of mEnterococcus agar and incubated for 48+/-2 hours at 35+/-0.5°C. All colonies that are red, maroon or pink are counted as fecal streptococcus. The maximum number of target colonies per filter for counting purposes is 150.

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank filter between each sample.
Duplicate samples on $\geq 5\%$ of samples.

Media QC: Comparison of target colonies on an old vs. a new batch.

Reporting: Results are qualified by "A" (for approximate) if the number of target colonies/filter is low and a small volume was filtered or if the plate is overcrowded.

If the target colony count/filter exceeds the upper counting limit of 150, the result is reported as $>(\frac{150}{\text{mL}} \times 100)$ mL filtered.

If there is no recovery of target organisms, the result is recorded as $<(\frac{1}{\text{mL}} \times 100)$ mL filtered.

Fecal Streptococcus – FSMF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 150 Counts/Filter

Control Filters:

	Number of Data	No. Positive	Data Affected
Blanks	1753	1	None

Duplicates:

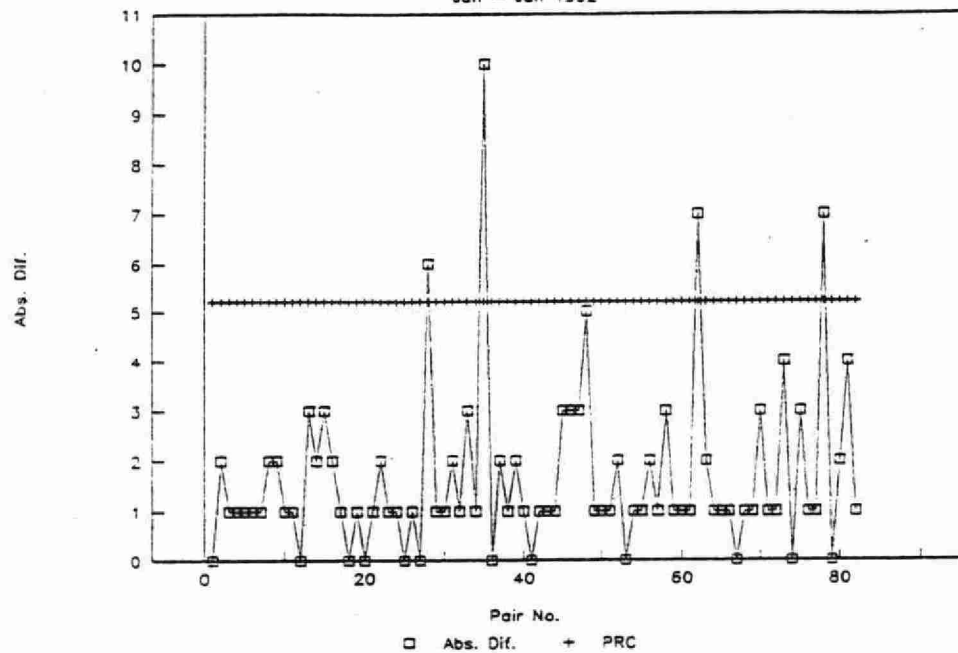
Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
174	0	20	1.9	1.9
29	21	80	6.0	4.4
0	81	100	–	–

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
12	12	12	12	None

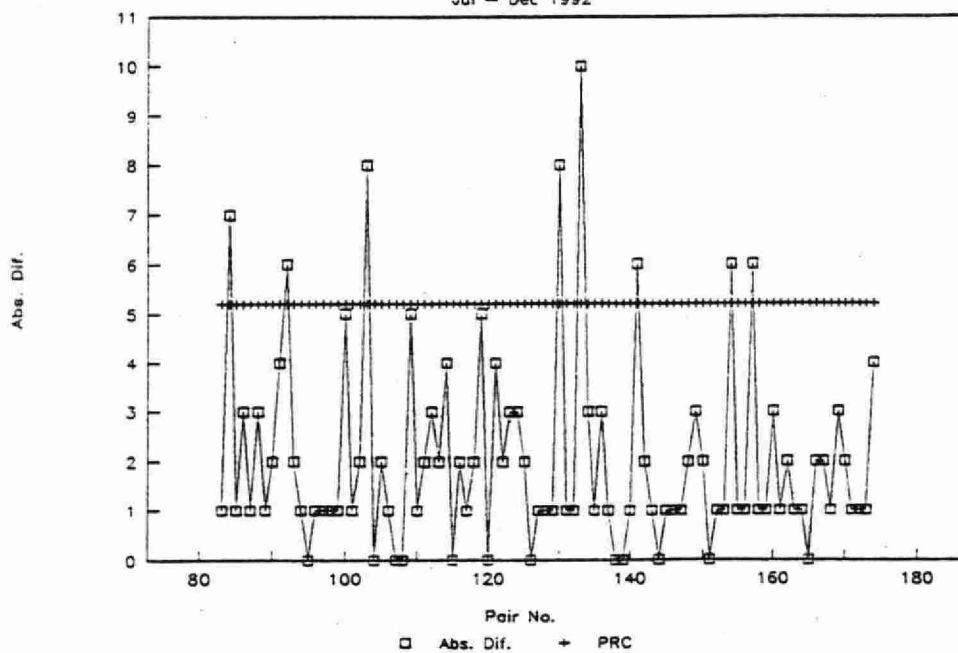
Fecal Strep.; 0-20 Range

Jan - Jun 1992



Fecal Strep.; 0-20 Range

Jul - Dec 1992



HETEROTROPHS

IDENTIFICATION:

LIS Test Name Code: HB35MF
Work Station Code: TBMF
Method Code: E6000A

Method Introduced: 1979
Units: Counts/mL
Section: Microbiology

SAMPLE TYPE/MATRIX: Drinking Water

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the surface of SPC agar and incubated for 48+/-3 hours at 35 +/-0.5°C. All colonies are counted as heterotrophs.

CONTROLS AND QUALITY ASSURANCE:

Controls: Duplicate samples on $\geq 5\%$ of samples.
Media QC: Comparison of colony counts on an old vs. a new batch.
Reporting: Results are reported as counts/mL.
External QC Checks: SPC agar tested with an E. coli quality control culture (lot #121589) from the USEPA.

Heterotrophs – HB35MF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 1000 Counts/Filter

Duplicates:

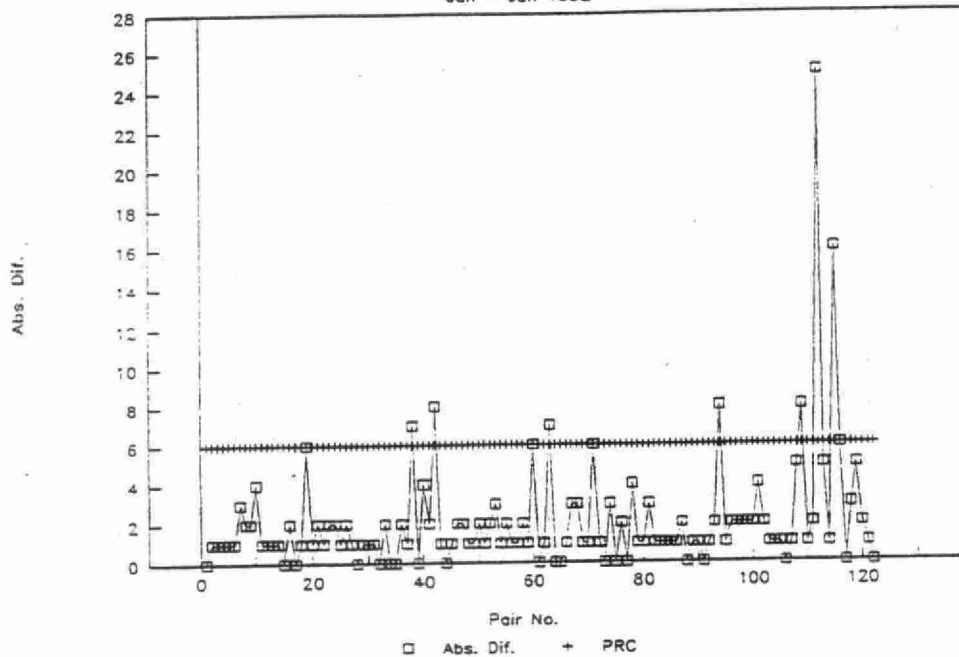
Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
220	0	20	2.2	2.7
36	21	80	6.9	5.4
11	81	1000	12.0	9.8

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
22	22	22	22	None

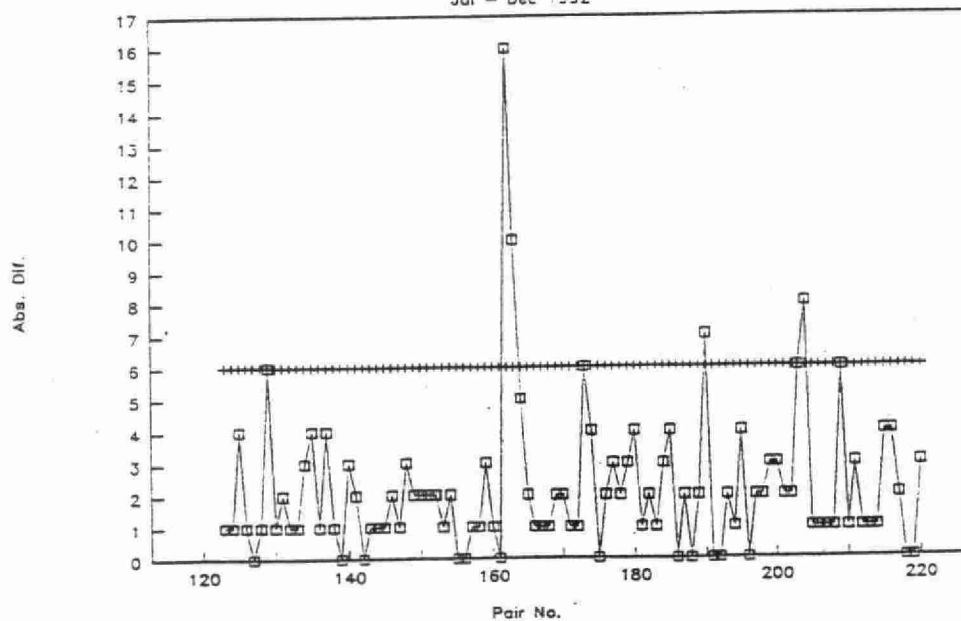
Heterotrophs; 0-20 Range

Jan - Jun 1992



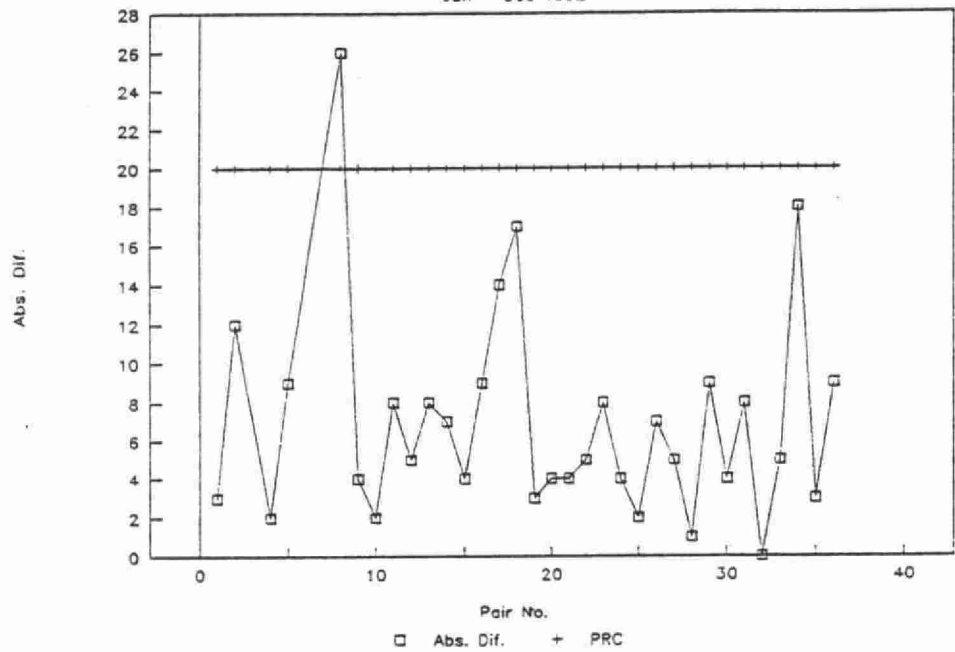
Heterotrophs; 0-20 Range

Jul - Dec 1992



Heterotrophs; 21-80 Range

Jan - Dec 1992



PRESENCE-ABSENCE TEST

IDENTIFICATION:

LIS Test Name Code: TBPA
Work Station Code: TBPA
Method Code: E6022A

Method Introduced: 1969
Units: Present/Absent/100 mL
Section: Microbiology

SAMPLE TYPE/MATRIX: Drinking Water

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

A 100 mL volume of sample is added to a presence-absence (P-A) bottle. The bottle is incubated at 35°C for 4 days and examined every 24 hours for acid and/or gas formation. When a positive reaction occurs, the inoculum is transferred to confirmatory media to determine the presence of total coliforms, fecal coliforms and other indicator organisms.

CONTROLS AND QUALITY ASSURANCE:

Controls: A blank control sample is included every 20 to 25 samples.

Media QC: PA broth batches are checked for sterility.

Inoculation of the medium is done with various organisms to determine its response.

Reporting: Microbiological parameters are reported as either present or absent per 100 mL of sample.

Presence – Absence – TBPA

Quality Control Data from January 1 to December 31, 1992

Blank Controls:

Number of Samples	Number of Controls	Number of Positive Controls	Number of Indicator Organisms
16096	896	5	0

Media Quality Control:

Number of Batches	Passed Medium QC Check
24	24

Pseudomonas aeruginosa

IDENTIFICATION:

LIS Test Name Code: PSAMF	Method Introduced: 1978
Work Station Code: TBMF	Units: Counts/100 mL
Method Code: E6016A	Section: Microbiology

SAMPLE TYPE/MATRIX: Surface and Waste Waters

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the surface of mPAE agar and incubated for 48 +/-2 hours at 41.5+/-0.5°C. All colonies that are dark brown/brown with darkened centers are counted as Pseudomonas aeruginosa. The maximum target colonies counted per plate is 150.

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank filter between each sample
Duplicate samples on $\geq 5\%$ of samples

Media QC: Comparison of target counts on an old vs. a new batch.

Reporting: Results are qualified by "A" (for approximate) if the number of target colonies/filter is low and a small volume was filtered or if the plate is overcrowded.

If the target colony count/filter exceeds the upper counting limit of 150, the result is reported as:
$$> \frac{(150 \times 100)}{\text{mL filtered.}}$$

If there is no recovery of target organism, the result is recorded as:
$$< \frac{(1 \times 100)}{\text{mL filtered.}}$$

NOTE: The frequency of samples that actually have counts of P. aeruginosa is low; hence, at this time there is not enough data to set limits for this test.

Pseudomonas aeruginosa – PSAMF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 150 Counts/Filter

Control Filters:

	Number of Data	No. Positive	Data Affected
Blanks	280	4	None

Duplicates:

Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
14	0	20	1.7	2.0
0	21	80	–	–
0	81	100	–	–

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
9	9	9	9	None

TOTAL COLIFORMS

IDENTIFICATION:

LIS Test Name Code: TCMF	Method Introduced: 1968
Work Station Code: TBMF	Units: Counts/100 mL
Method Code: E6023A	Section: Microbiology

SAMPLE TYPE/MATRIX: Surface and Drinking Water

SAMPLING:

Requirements: Bottle filled to top of label
Container: 250 mL glass or plastic
Preservative: Sodium thiosulfate, 100 mg/L

ANALYTICAL PROCEDURE:

Samples are analyzed by the membrane filter (MF) procedure using aseptic technique. The sample and or dilution water are filtered through a water permeable membrane which traps the bacteria on the filter. The filter is placed onto the surface of mENDO-LES agar and incubated for 22+/-2 hours at 35+/-0.5°C. All colonies with a dull to bright metallic green-gold sheen are counted as coliforms. The maximum number of target colonies per filter for counting purposes is 150.

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank control filter between each sample.
Duplicate samples on $\geq 5\%$ of samples.

Media QC: Target and non-target organisms are filtered onto mENDO LES.

Reporting: Results are qualified by "A" (for approximate) if the number of target colonies/filter is low and a small volume was filtered or if the plate is overcrowded.

If the target colony count/filter exceeds the upper counting limit of 150, the result is reported as $>(\frac{150 \times 100}{\text{mL filtered}})$

If there is no recovery of target organisms, the result is recorded as $<(\frac{1 \times 100}{\text{mL filtered}})$

TOTAL COLIFORMS

CONTROLS AND QUALITY ASSURANCE (Cont'd)

External QC mENDO-LES tested with an E. coli quality control
Checks: culture (lot #121589) from the USEPA.

Participated in an Ontario Ministry of Health
Interlaboratory Study in 1991.

CAEAL certified.

Total Coliforms – TCMF

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0 – 150 Counts/Filter

Control Filters:

	Number of Data	No. Positive	Data Affected
Blanks	2899	1	1

Duplicates:

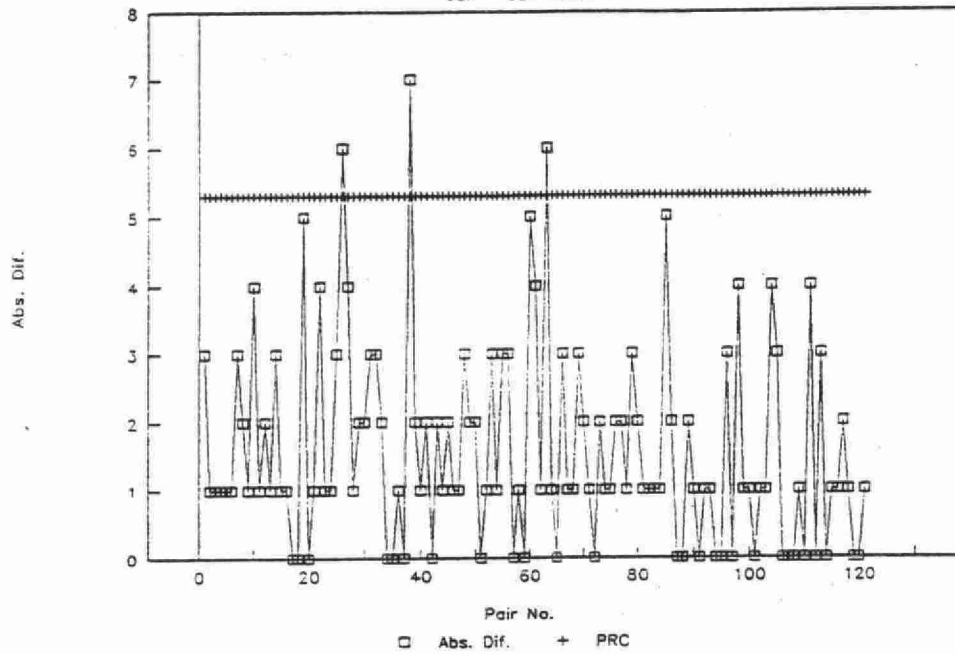
Number of Data Pairs	Counts per Filter		Mean Difference	Standard Deviation
254	0	20	1.7	1.6
25	21	80	4.7	3.9
0	81	100	–	–

Media Quality Control:

Number of Batches	Passed Quantitative Check	Passed Colony Check	Passed Sterility Check	Batches Rejected
55	–	55	–	None

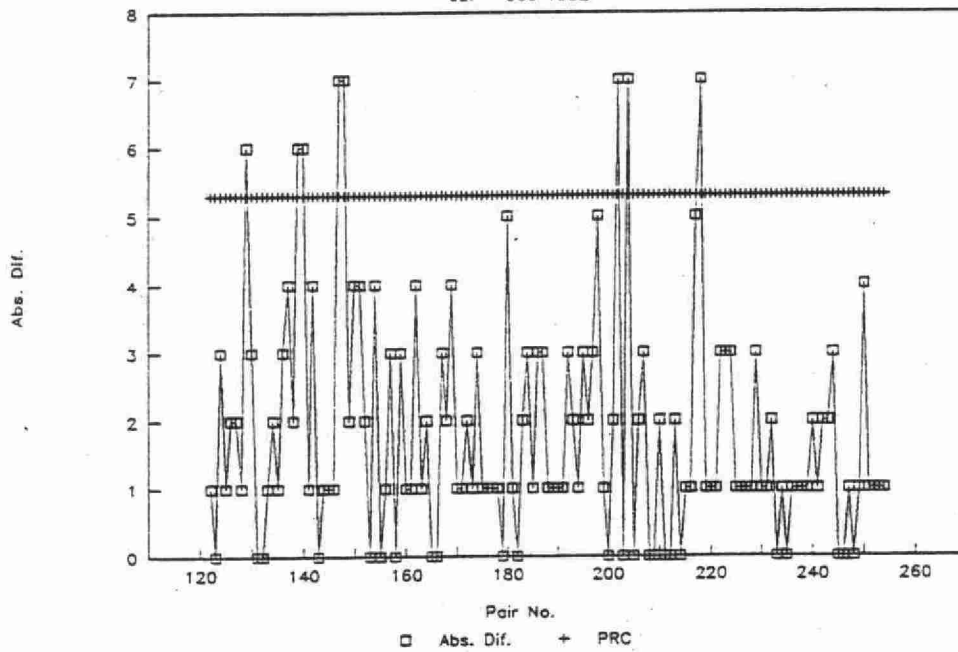
Total Coliforms; 0 - 20 Range

Jan - Jun 1992



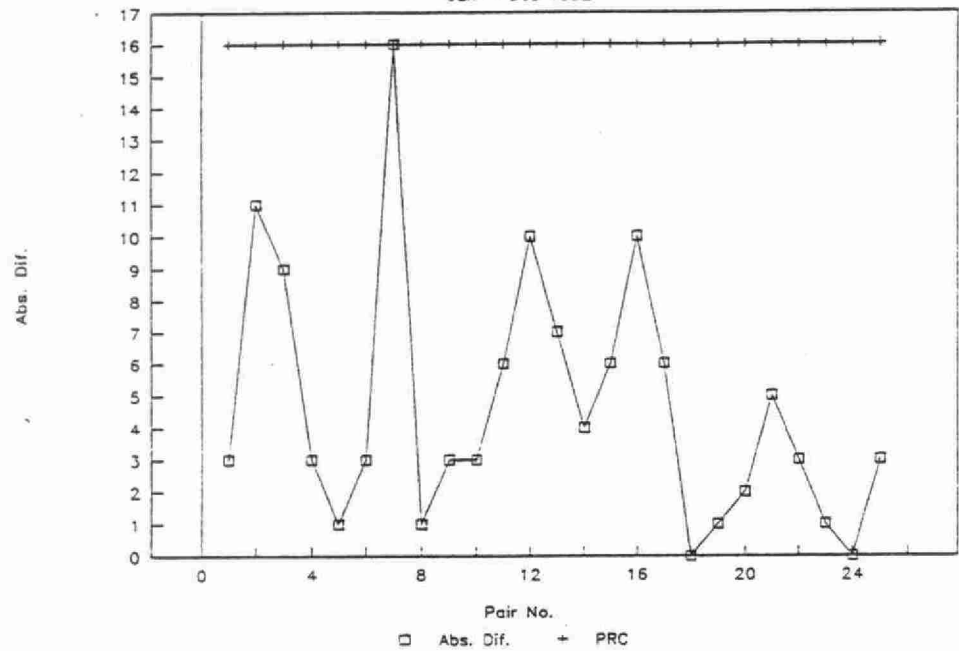
Total Coliforms; 0 - 20 Range

Jul - Dec 1992



Total Coliforms; 21-80 Range

Jan - Dec 1992



4.0

Water Quality Performance Summaries

***** ACIDITY - TOTAL FIXED ENDPOINT *****

IDENTIFICATION:

LIS Test Name Code:	ACDT	Introduced:	78/08/01
Work Station Code :	TBACDT	Units :	mg/L as CaCO ₃
Method Code :	E6001A.1	Section :	Water Quality

SAMPLE TYPE/MATRIX: Surface water, drinking water, ground water, snow, precipitation and industrial waste.

SAMPLING:

Special Instructions: Bottles to be completely full so no air remains after capping.

Container : PET or glass

Preservative : 4°C

ANALYTICAL PROCEDURE:

Sample aliquot (50 mL) is titrated with CO₂ free standardized 0.02N NaOH to a pale pink colour (endpoint pH 8.3), using phenolphthalein as the indicator. A pH meter is used to distinguish the endpoint in highly coloured samples.

INSTRUMENTATION:

Brinkman Autoburette with digital display.

PH meter accurate to 2 decimal places.

CALIBRATION:

Potassium Hydrogen Phthalate titrated against the NaOH working standard.

CONTROLS AND QUALITY ASSURANCE:

Duplicates: DUP (1 every 10 samples, minimum - 1 per run)

Reporting:	Maximum Significant Figures: Whole Numbers		
W Value:	N/A	T Value:	N/A

MODIFICATIONS:

1986-Phenolphthalein indicator used for end-point determination. pH meter used exclusively prior to this date.

ACIDITY

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 40 mg/L as CaCO₃

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
42	0 – 8	3.870	0.3780
15	8 – 20	13.498	0.9156
3	20 – 40	28.667	1.4720

***** ALKALINITY - GRAN *****

IDENTIFICATION:

LIS Test Name Code:	ALKTI	Introduced:	1980
Work Station Code :	TBTFE	Units :	mg/L CaCO ₃
Method Code :	E6010A	Section :	Water Quality

SAMPLE TYPE/MATRIX: Surface water and precipitation samples with suspected low alkalinities.

SAMPLING:

Special Instructions: Fill bottle completely.
Container : PET or glass
Preservative : 4°C

ANALYTICAL PROCEDURE:

An aliquot of sample (usually 100 mLs) is titrated with 0.02N sulphuric acid under the control of a microcomputer to a pH end-point of <3.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant. Once a complete titration curve is obtained, the Gran method of analysis is used to determine the end-point volume and this, in turn, is used to calculate the Inflection Point (IP) alkalinity.

INSTRUMENTATION:

Auto-Burette, Radiometer ABU91, with 5.0 mL total delivery burette assembly and BCD internal pH meter, combination pH electrode, microcomputer with appropriate software (in-house design).

CALIBRATION:

3 standard buffers - pH value 4.01, 6.86 and 9.18.

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA AND QCB
Duplicates : DUP (1 for every 15 samples, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: N/A T Value: N/A

LRTAP participant

MODIFICATIONS:

Sept. 1992 - TRS-80 computer and software was replaced by Radiometer Auto-Burette and microcomputer with in-house software.

NOTE: New instrumentation, insufficient data for charting.

***** ALKALINITY - TOTAL FIXED ENDPOINT *****

IDENTIFICATION:

LIS Test Name Code:	ALKT	Introduced:	1978
Work Station Code :	TBCAP	Units :	mg/L CaCO ₃
Method Code :	E6003A.1	Section :	Water Quality

SAMPLE TYPE/MATRIX: Surface water, drinking water, groundwater, industrial waste and sewage effluents.

SAMPLING:

Special Instructions: Fill bottle completely.
Container : PET or glass
Preservative : 4°C

ANALYTICAL PROCEDURE:

Samples are titrated with 0.02N sulphuric acid to pH <4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.

INSTRUMENTATION:

Radiometer CDM 83 Conductivity Meter, TTT85 titrator, ABU80 Auto-Burette, PRS12 Alpha Printer and an SAC80 Multisampler.

CALIBRATION:

3 standard buffers - pH value 4.01, 6.86 and 9.18.

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA AND QCB
Duplicates : DUP (1 for every 15 samples, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: N/A T Value: N/A

CAEAL Certified, LRTAP and QM Blind Audit participant.

MODIFICATIONS:

1986-Fisher Titralizer system replaced by Radiometer system.

1990-Long Term Blank now subtracted from Quality Control Solutions before charting.

ALKALINITY – TOTAL FIXED ENDPOINT

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 200 mg/L as CaCO₃

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	197	50	50.066	0.066	0.3346
QCB:	197	25	25.013	0.013	0.2181
QCA+QCB:	197	75	75.079	0.079	0.4927
QCA-QCB:	197	25	25.053	0.053	0.2763

For 1992 Control Charts:

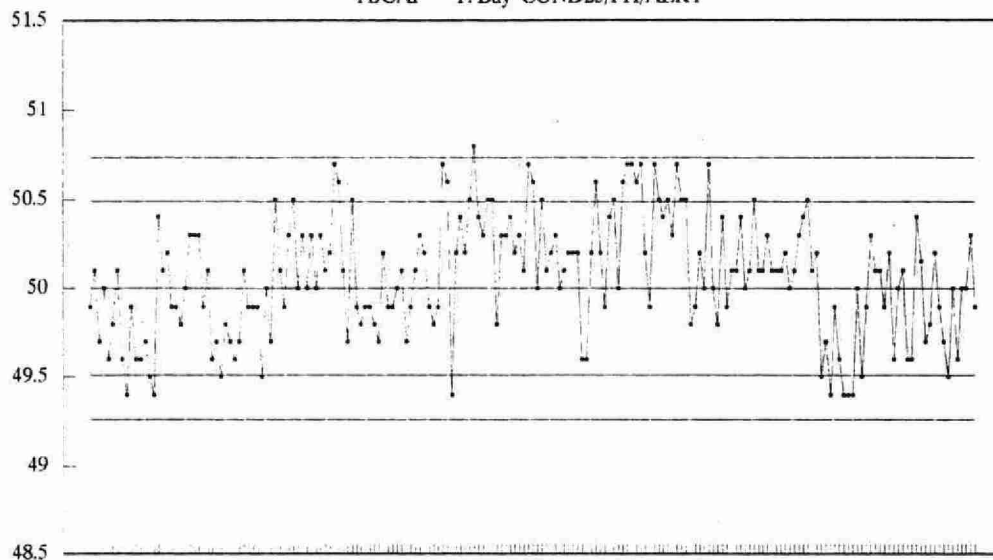
$$Sw (A-B) = 0.2454$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
177	0 – 40	18.556	0.1874
188	40 – 100	64.013	0.4790
99	100 – 200	140.144	0.5585

ALKT Alkalinity, Total

TBCAP T. Bay COND25/PH/ALKT

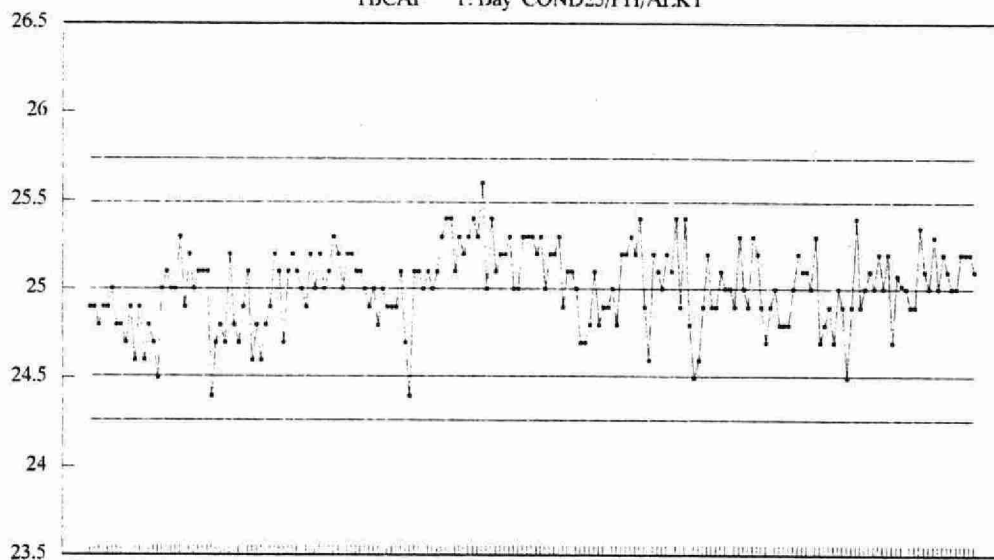


QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5021 - 7663

ALKT Alkalinity, Total

TBCAP T. Bay COND25/PH/ALKT

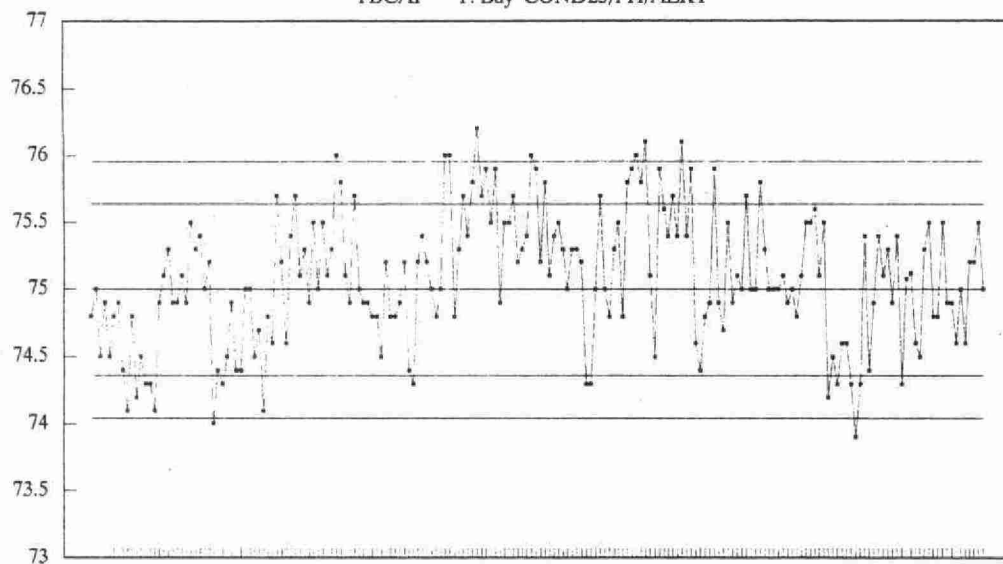


QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5021 - 7663

ALKT Alkalinity, Total

TBCAP T. Bay COND25/PH/ALKT

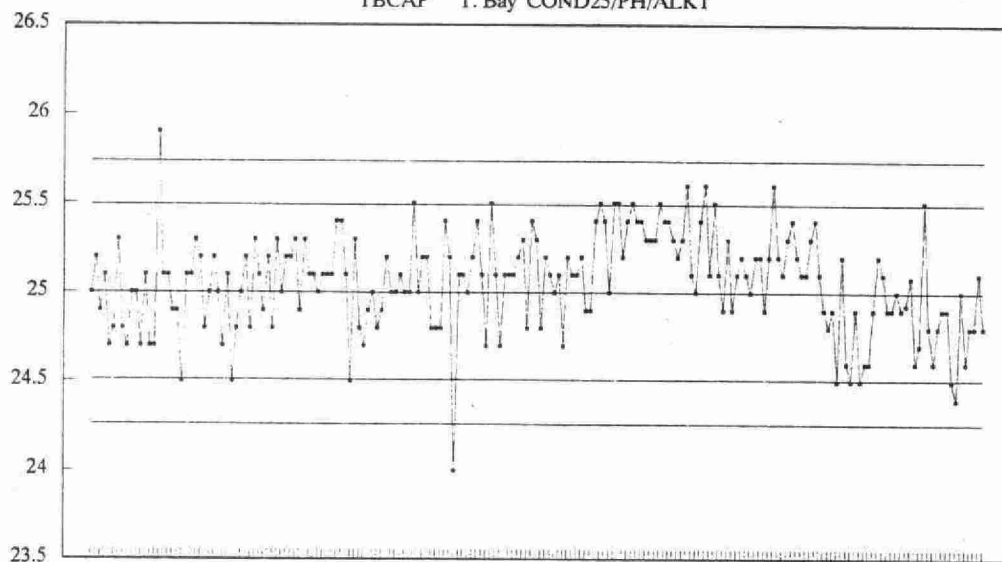


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5021 – 7663

ALKT Alkalinity, Total

TBCAP T. Bay COND25/PH/ALKT



— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5021 – 7663

***** AMMONIA *****

IDENTIFICATION:

LIS Test Name Code: NNHTFR	Introduced	: 1978
Work Station Code : TBNDNP	Units	: mg/L as N
Method Code : E6024A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Ammonia is converted to indophenol blue in a buffered alkaline media using sodium nitroprusside as a catalyst.
N.B. Nitrate plus nitrite, nitrite and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI with 37°C heating bath. Colourimetric measurement is through a 5.0 cm. light path at 630 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 0.80 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift : BLK every 10 samples, CHK (100%) every 20 samples
Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: 0.01 T Value: 0.05

LRTAP and QM Blind Audit participant.

MODIFICATIONS:

1988 - All channels went to microcomputer control with DCI software.

AMMONIA

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 0.8 mg/L as N

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	74	0.640	0.637	-0.003	0.0064
QCB:	74	0.160	0.153	-0.007	0.0043
QCC:	74	0.064	0.057	-0.007	0.0640
QCA+QCB:	74	0.800	0.790	-0.010	0.0095
QCA-QCB:	74	0.480	0.484	0.004	0.0054
QCB+QCC:	74	0.224	0.211	-0.013	0.0078
QCB-QCC:	74	0.096	0.096	0.000	0.0045

For 1992 Control Charts:

Sw (A-B) = 0.0063

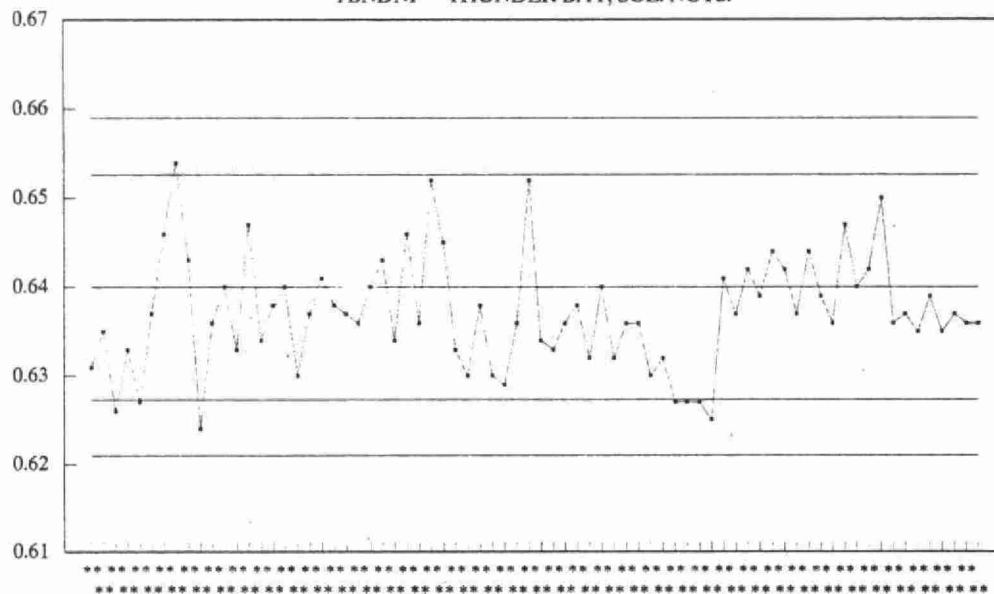
Sw (B-C) = 0.0063

Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
170	0.00	0.16	0.030	0.0039
26	0.16	0.4	0.269	0.0079
9	0.4	0.8	0.482	0.0105

NNHTFR Ammonia, Totl, Frac.Reac

TBNDNP THUNDER BAY, SOL. NUTS.

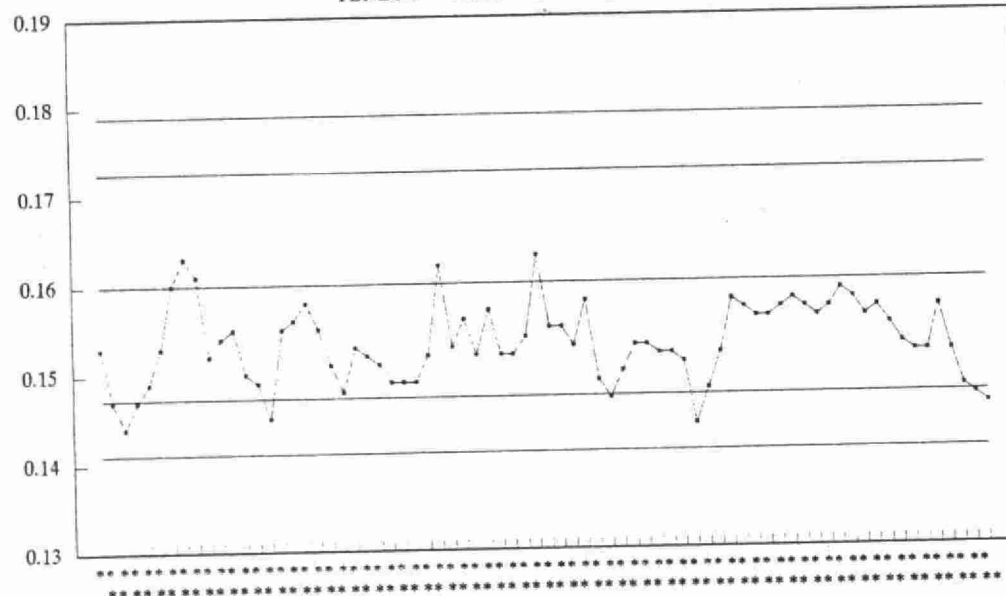


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5050 – 7648

NNHTFR Ammonia, Totl, Frac.Reac

TBNDNP THUNDER BAY, SOL. NUTS.

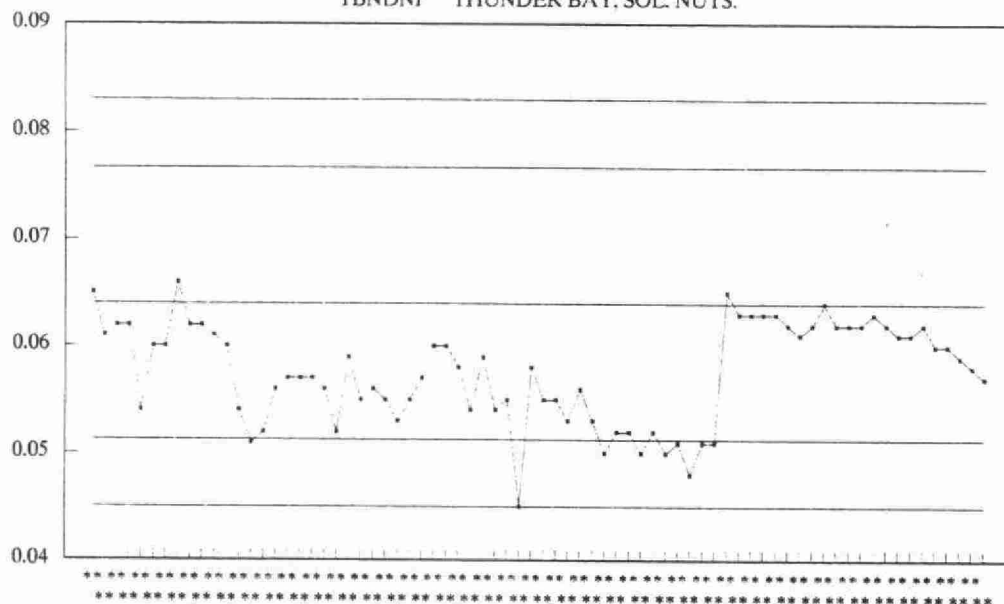


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5050 – 7648

NNHTFR Ammonia, Totl, Frac.Reac

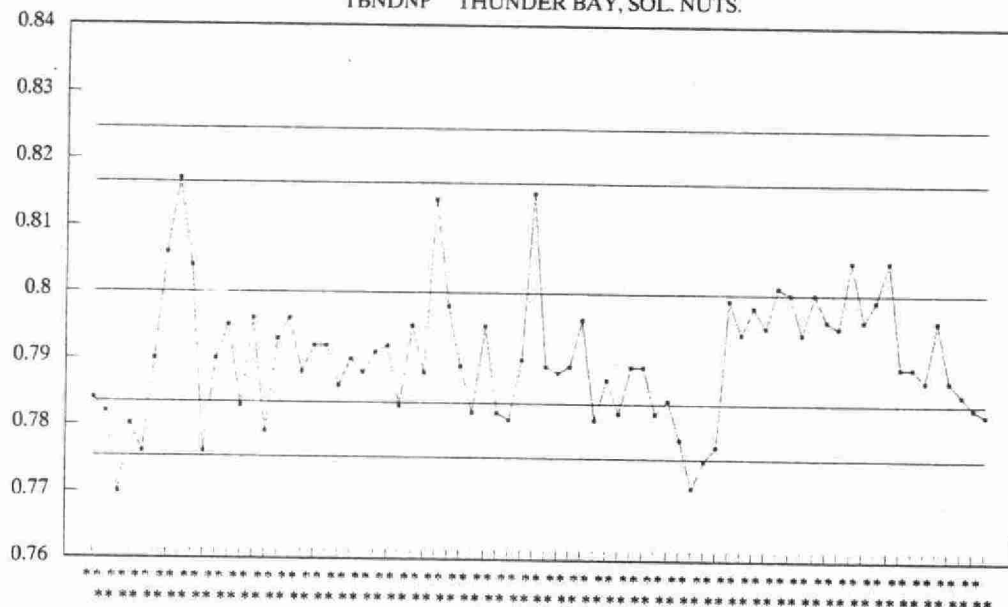
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNHTFR Ammonia, Totl, Frac.Reac

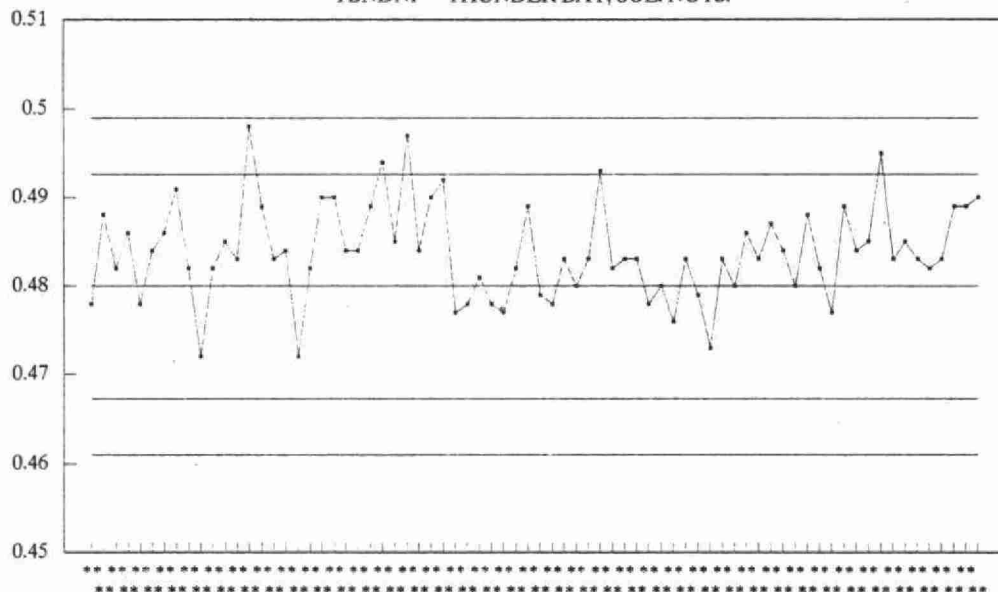
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNHTFR Ammonia, Totl, Frac.Reac

TBNDNP THUNDER BAY, SOL. NUTS.

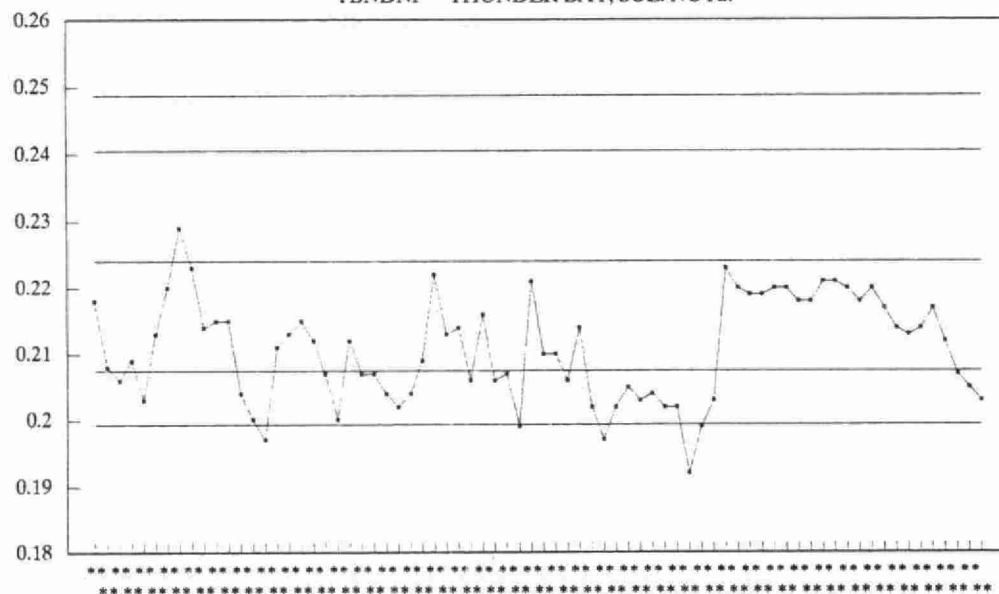


— QCA-QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNHTFR Ammonia, Totl, Frac.Reac

TBNDNP THUNDER BAY, SOL. NUTS.

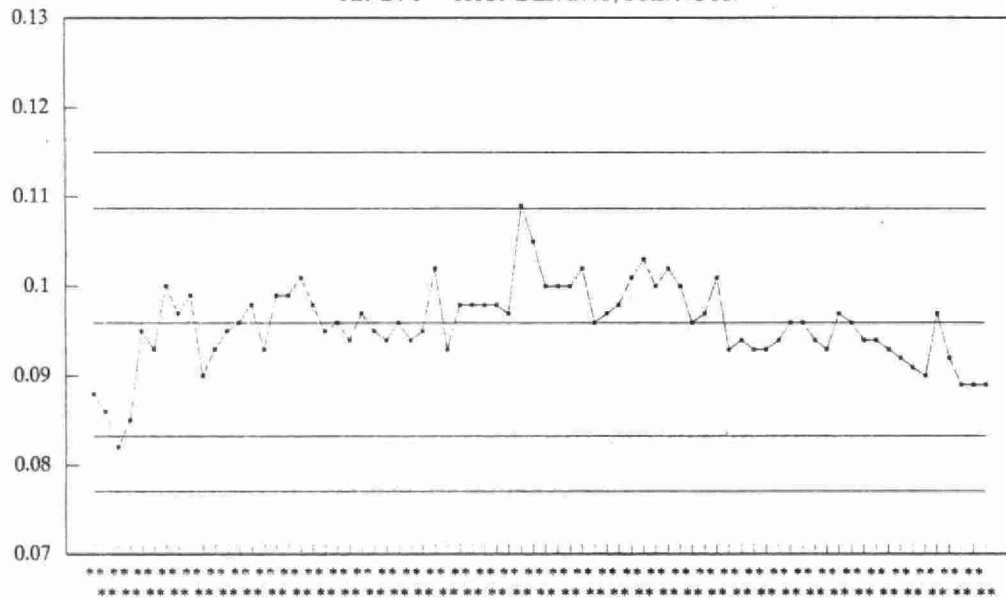


— QCB+QCC

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNHTFR Ammonia, Totl, Frac.Reac

TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

— QCB-QCC

***** BIOCHEMICAL OXYGEN DEMAND *****

IDENTIFICATION:

LIS Test Name Code:	BOD5	Introduced	: May, 1981
Work Station Code :	TBBOD5	Units	: mg/L as BOD
Method Code	: E6027A	Section	: Water Quality

SAMPLE TYPE/MATRIX: Sewages, industrial wastes, landfill leachates and surface waters.

SAMPLING:

Special Instructions: Store in dark.

Container : PET or glass

Preservative : 4°C

SAMPLE PREPARATION:

If necessary, sample pH is adjusted to neutral and chlorine is removed by reaction with sodium thiosulphate.

ANALYTICAL PROCEDURE:

Using dissolved oxygen (DO) analysis, samples are measured for oxygen depletion before and after a five day period of storage in the dark at 20°C. Dilutions are made with aerated, nutrient-enriched water to obtain a 50-75% oxygen depletion. If the sample has undergone a preparation step as above, has been frozen or is an industrial waste, a sewage seed is added and the appropriate seed correction is made.

INSTRUMENTATION:

YSI Oxygen Meter, Model 58, and YSI DO probe with stirrer fitted with a high sensitivity membrane which is permeable to oxygen. Titration equipment for Winkler analysis of dissolved oxygen. Incubator capable of maintaining 20°C ± 1°C.

CALIBRATION:

Dilution water is analyzed by Winkler titration for DO concentration. This water, now with a "known" DO value is used to standardize the oxygen meter.

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 DO samples, QCA, QCB

Recovery : 3 Recovery Samples

Drift : DO sample after every six samples

Duplicates : DUP (1 per 20 samples)

Reporting: Maximum Significant Figures: 2
W Value: 0.10 T Value: 0.50

CAEAL certified, QM Blind Audit participant

BIOCHEMICAL OXYGEN DEMAND

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 200 mg/L as BOD

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	93	200	203.172	3.172	7.7944
QCB:	93	100	102.817	2.817	4.0451
QCA+QCB:	93	300	305.989	5.989	10.3459
QCA-QCB:	93	100	100.355	0.355	6.8697

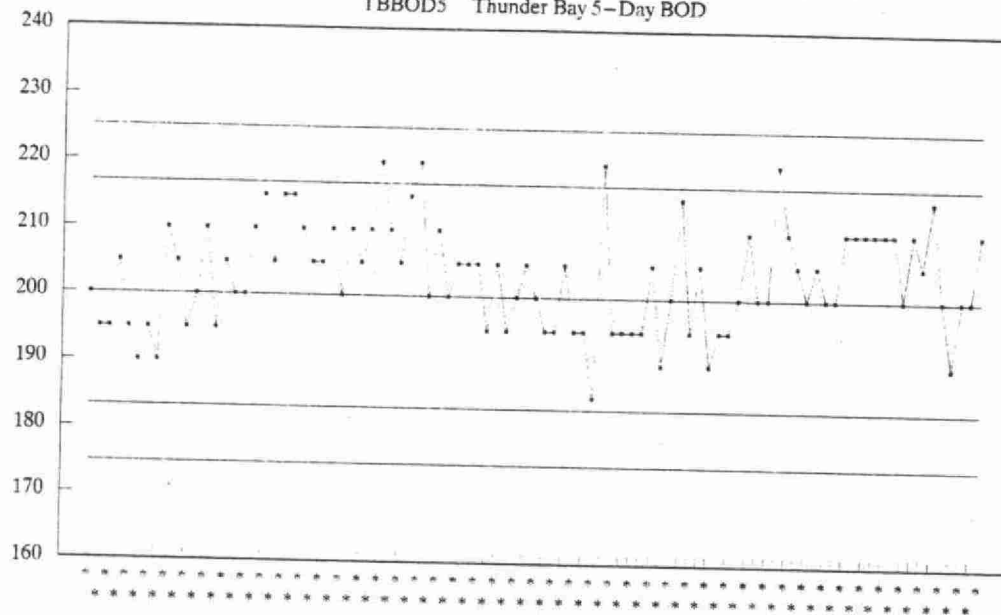
For 1992 Control Charts:

$$S_w (A-B) = 8.4068$$

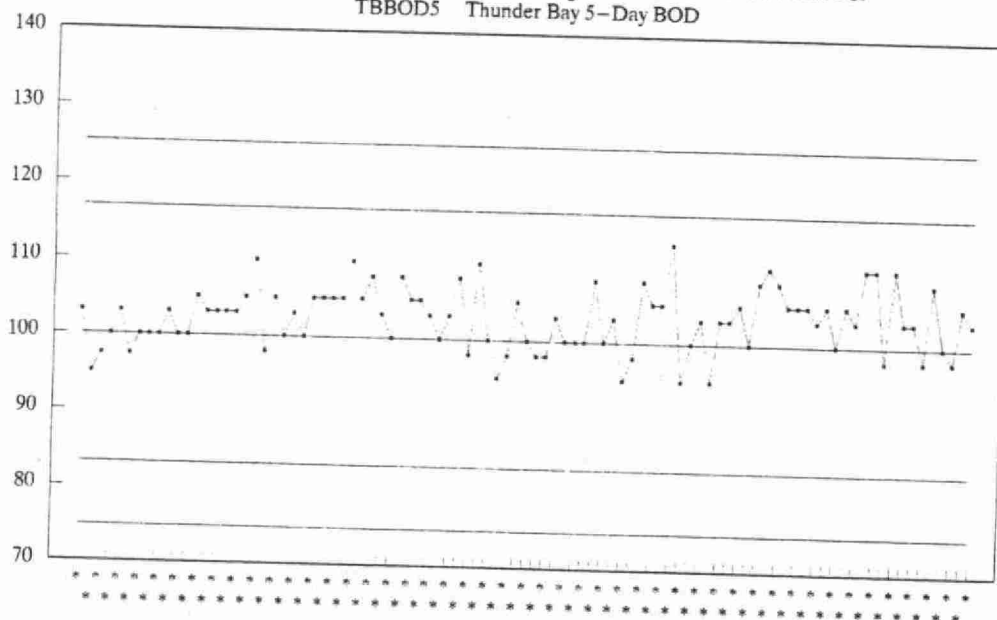
Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
167	0 – 40	13.752	1.8172
65	40 – 100	67.615	4.6434
17	100 – 200	134.118	9.1716

BOD5 BOD, 5 Day, Total Demand TBBOD5 Thunder Bay 5-Day BOD

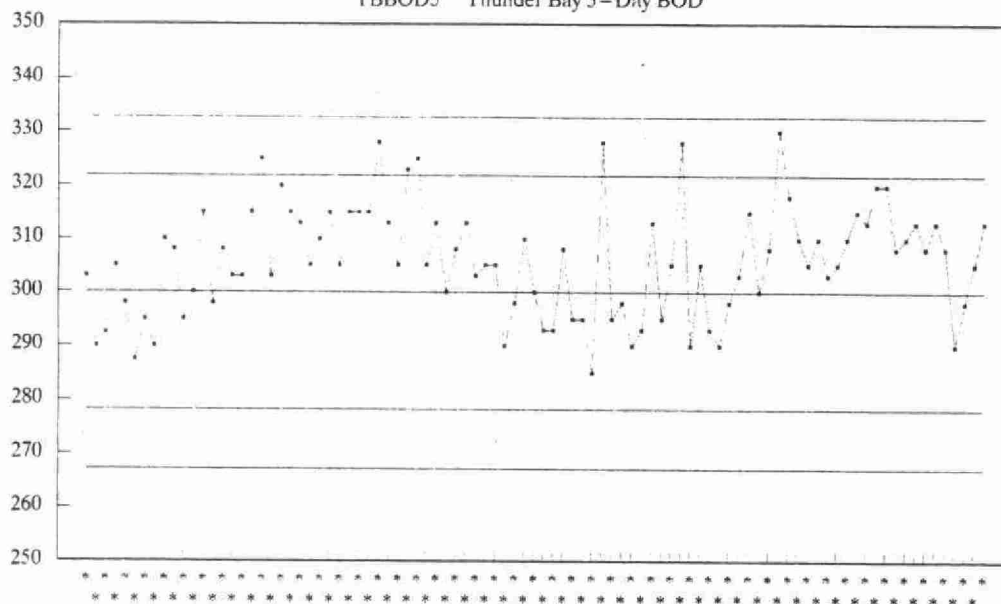


BOD5 BOD, 5 Day, Total Demand TBBOD5 Thunder Bay 5-Day BOD



BOD5 BOD, 5 Day, Total Demand

TBBOD5 Thunder Bay 5-Day BOD

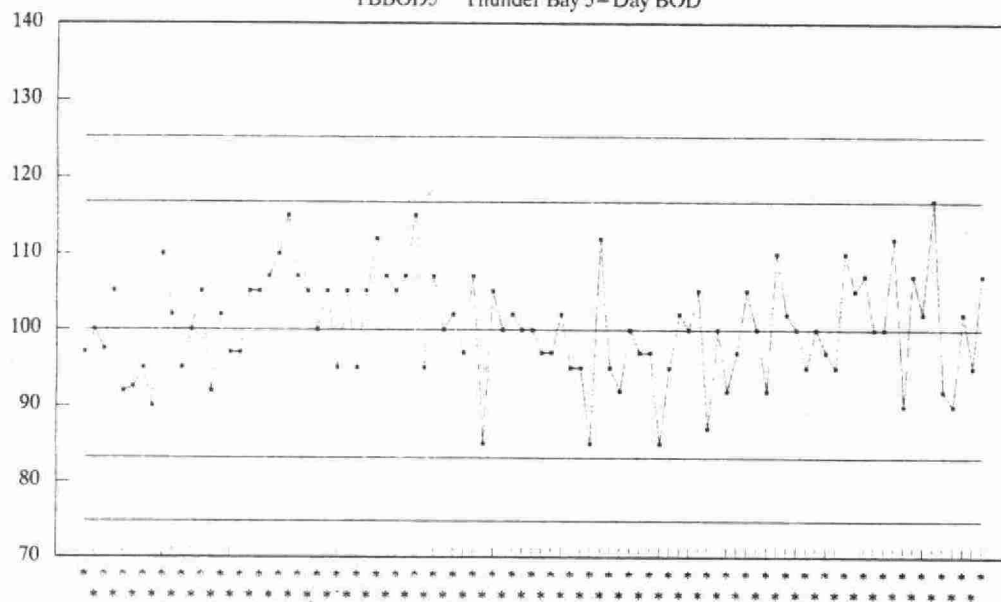


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5012 – 7657

BOD5 BOD, 5 Day, Total Demand

TBBOD5 Thunder Bay 5-Day BOD



— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5012 – 7657

***** CHEMICAL OXYGEN DEMAND *****

IDENTIFICATION:

LIS Test Name Code: COD	Introduced	: February, 1981
Work Station Code : TBCOD	Unit	: mg/L as O ₂
Method Code : E6028A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewage, leachates, industrial waste, surface and domestic waters.

SAMPLING:

Special Instructions: Freeze sample if delays are unavoidable.
Container : PET
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Samples (5 or 10 mls) are mixed with acidified potassium dichromate which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a convection oven for 3 hours at 150°C. The digested standards and blanks are then read using a spectrophotometer.

INSTRUMENTATION:

Spectronic 20, set at a wavelength of 600 nm.

CALIBRATION:

- Linear
- 6 Standards, 20 - 900 mg/L COD

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift : 2 Undigested Blanks, ZERO %T check every 10 samples
Duplicates : DUP (1 per 10 samples)

QM Blind Audit participant

Reporting: Report to: 5-100 nearest 1, 100-1000 nearest 5
W Value: 5 T Value: 25

MODIFICATIONS:

February, 1981 - Analysis using HAMES reflux method initiated
July, 1983 - COD analysis was updated to the present procedure.

CHEMICAL OXYGEN DEMAND

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 900 mg/L as O₂

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	39	600	592.103	-7.897	14.6894
QCB:	39	200	198.923	-1.077	9.2178
QCC:	39	25	20.769	-4.231	7.2091
QCA+QCB:	39	800	791.026	-8.974	21.9587
QCA-QCB:	39	400	393.180	-6.820	10.9229
QCB+QCC:	39	225	219.692	-5.308	14.7223
QCB-QCC:	39	175	178.154	3.154	7.5587

For 1992 Control Charts:

$$Sw (A-B) = 10.8834$$

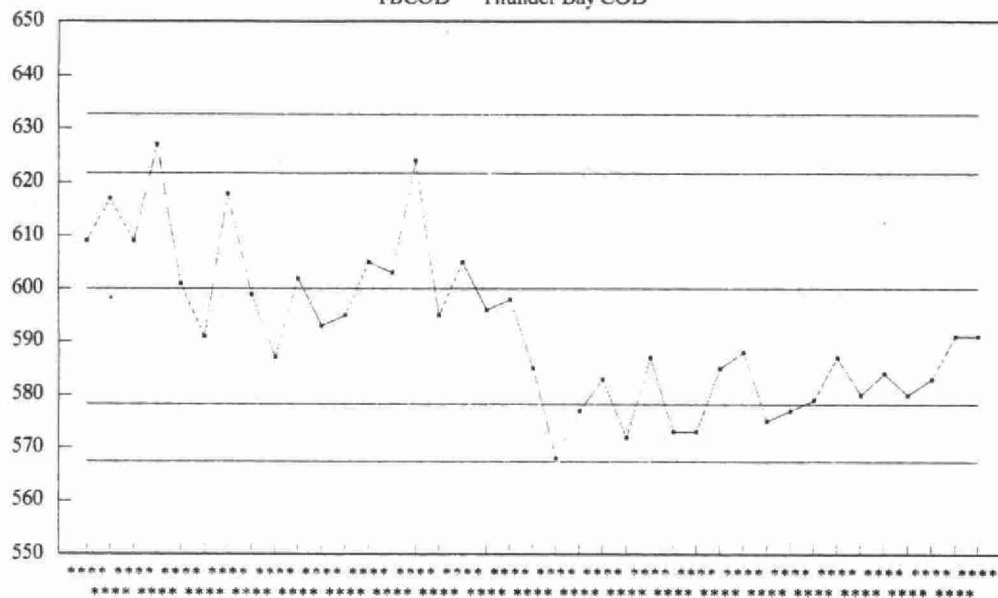
$$Sw (B-C) = 4.9021$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
45	0 – 180	39.014	5.0112
7	180 – 450	349.714	10.0285
0	450 – 900	0	0

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

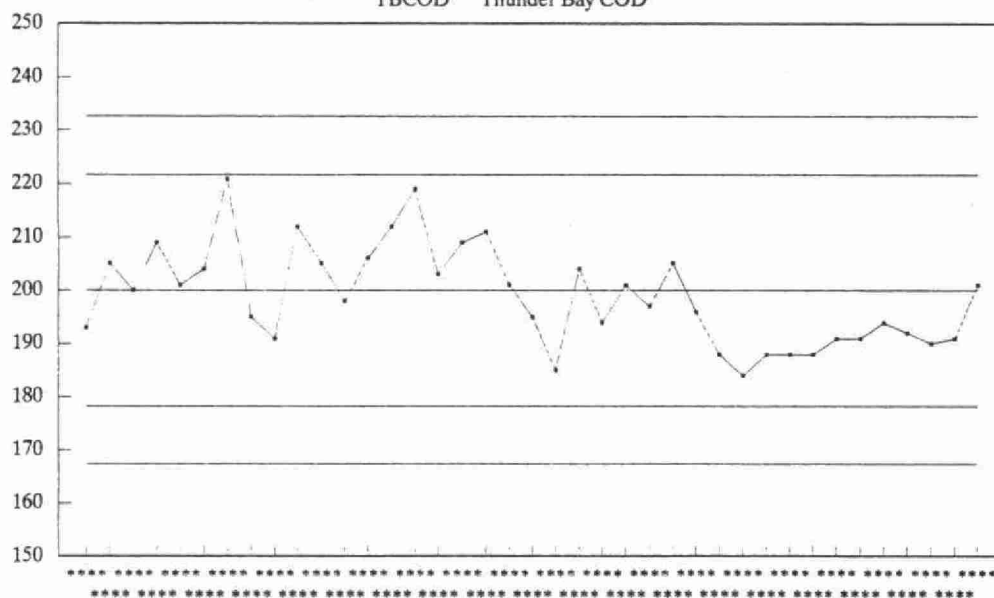


→ QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5069 – 7638

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

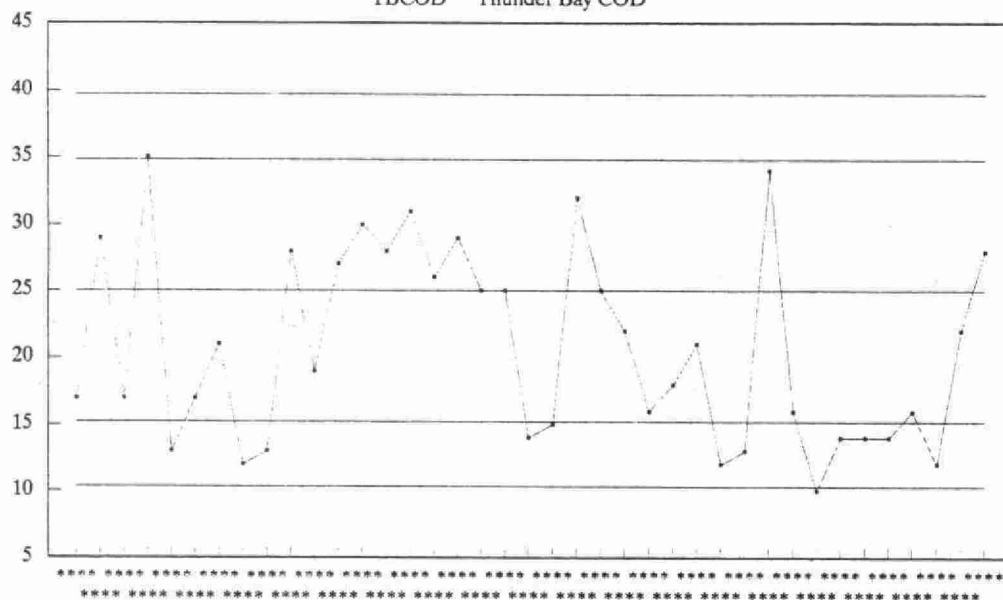


→ QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5069 – 7638

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

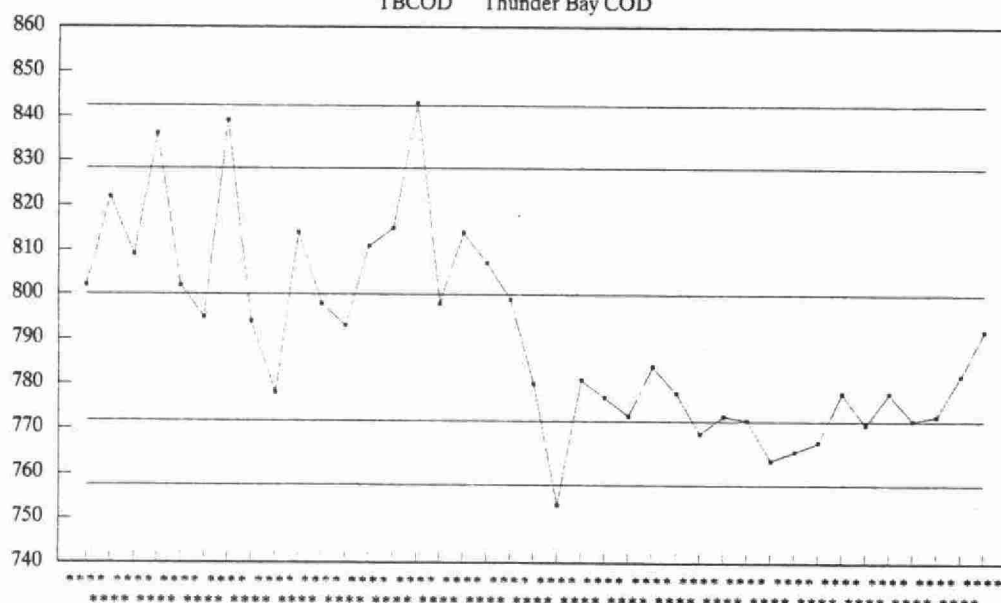


— QCC

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5069 – 7638

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

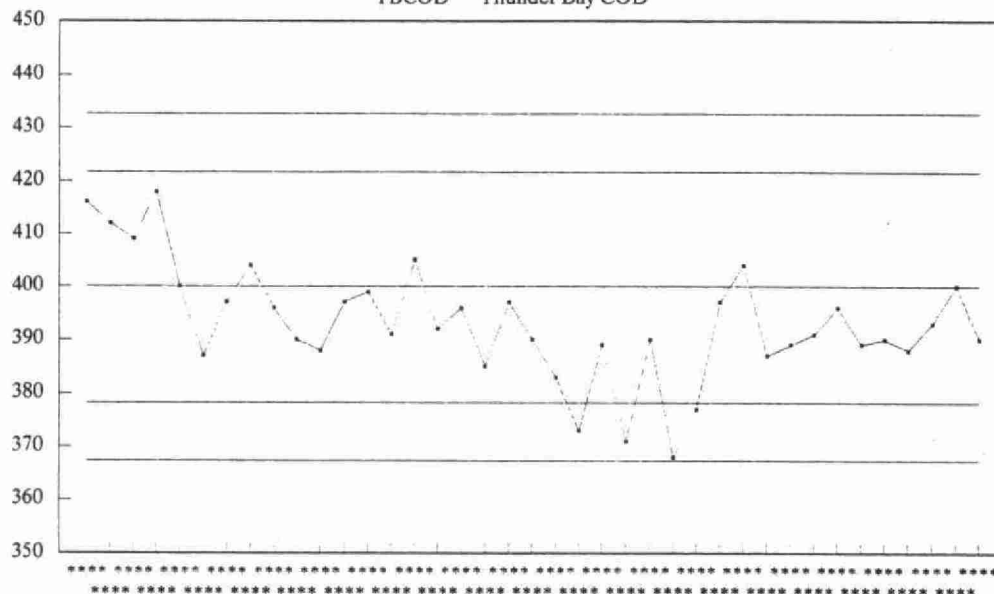


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5069 – 7638

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

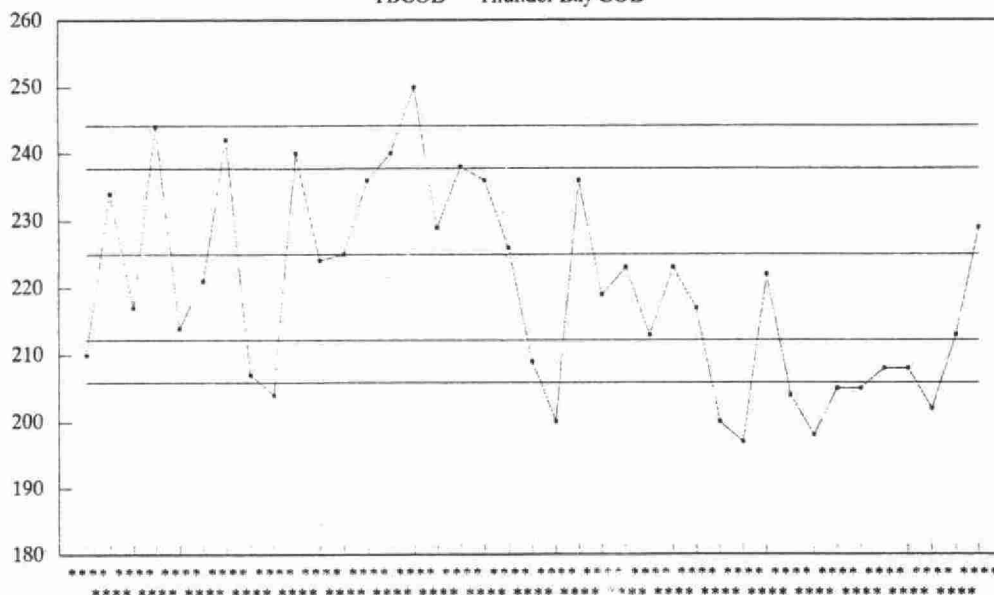


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5069 - 7638

QCA-QCB

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD

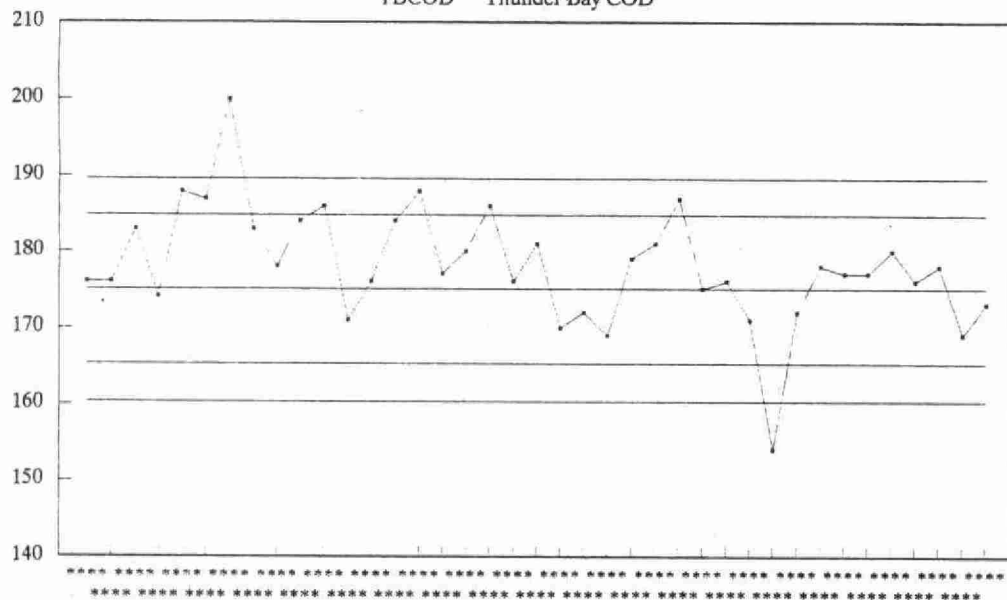


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5069 - 7638

QCB+QCC

COD Chemical Oxygen Demand

TBCOD Thunder Bay COD



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5069 - 7638

OCB-QCC

***** CHLORIDE *****

IDENTIFICATION:

LIS Test Name Code: CLIDUR	Introduced	: January 1980
Work Station Code : TBCLIDUR	Units	: mg/L as Cl
Method Code : E6002A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, precipitation, sewage, industrial effluent and landfill leachate.

SAMPLING:

Special Instructions:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

Chloride ions combine with mercuric thiocyanate to form mercuric chloride and release thiocyanate ions to complex with the ferric ion producing a coloured solution - the absorbance of which is proportional to the concentration of chloride ion.

INSTRUMENTATION:

Technicon Auto-Analyzer II continuous flow system with colourimetric measurement through a 50mm light path at 460 nm.

CALIBRATION:

- Linear
- 10 Standards, 0-10 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB

Drift : BLK (every 10 samples), SENS.CHK, (2 every 20 samples)

Duplicates : DUP (1 for every 15 samples, run at beginning)

Reporting:	Maximum Significant Figures: 2
	W Value: .05 T Value: 2.5

CAEAL Certified, LRTAP and QM Blind Audit participants

CHLORIDE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 10 mg/L as Cl

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	68	8	8.024	0.024	0.0408
QCB:	68	2	2.060	0.060	0.0355
QCA+QCB:	68	10	10.084	0.084	0.0648
QCA-QCB:	68	6	5.964	-0.036	0.0407

For 1992 Control Charts:

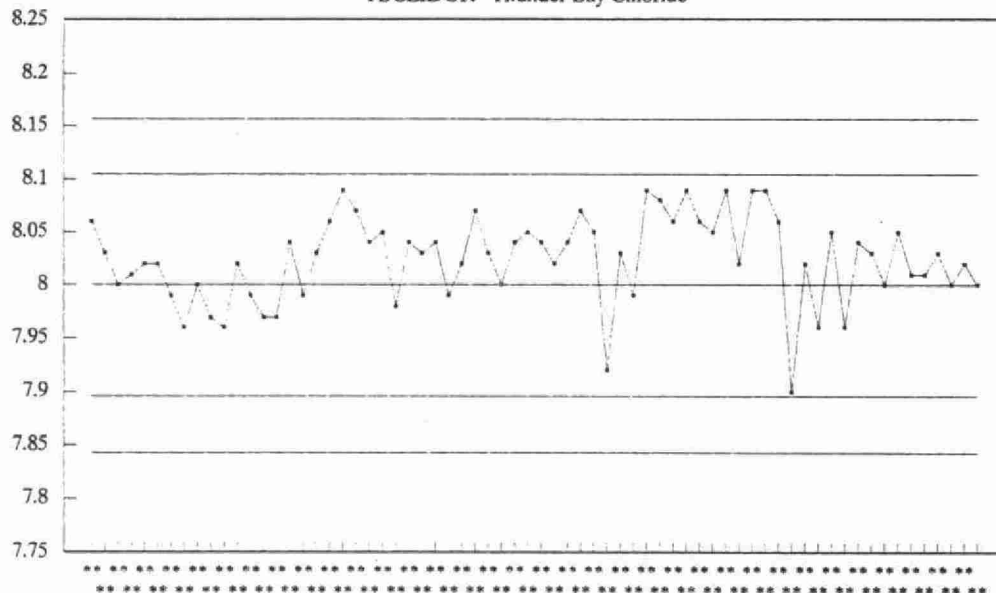
$$Sw (A-B) = 0.0522$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
122	0 - 2	1.0062	0.0386
68	2 - 5	3.1387	0.0686
66	5 - 10	7.1968	0.2419

CLIDUR Chloride, Unf. Reactive

TBCLIDUR Thunder Bay Chloride

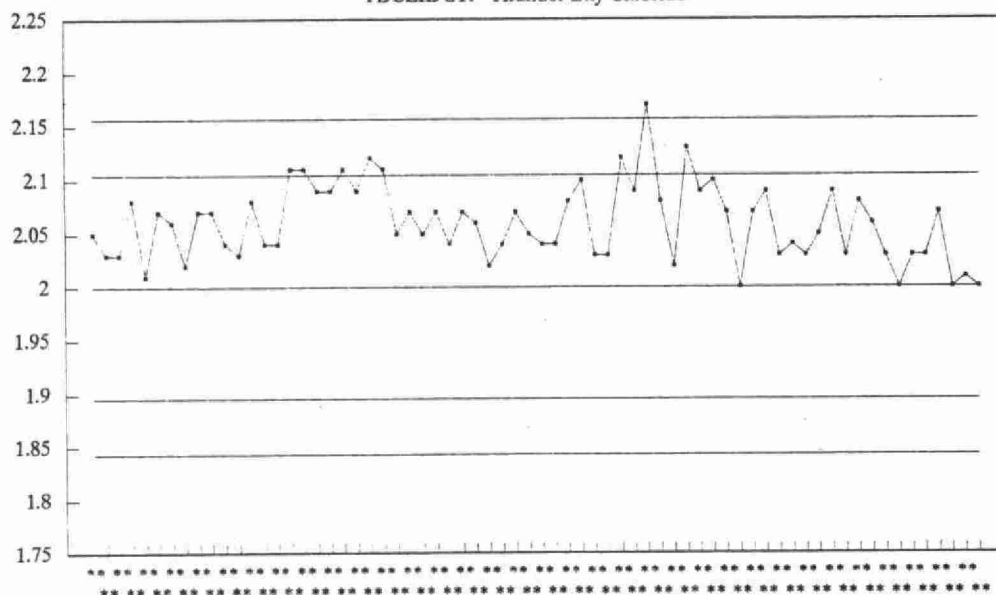


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5008 – 7586

CLIDUR Chloride, Unf. Reactive

TBCLIDUR Thunder Bay Chloride

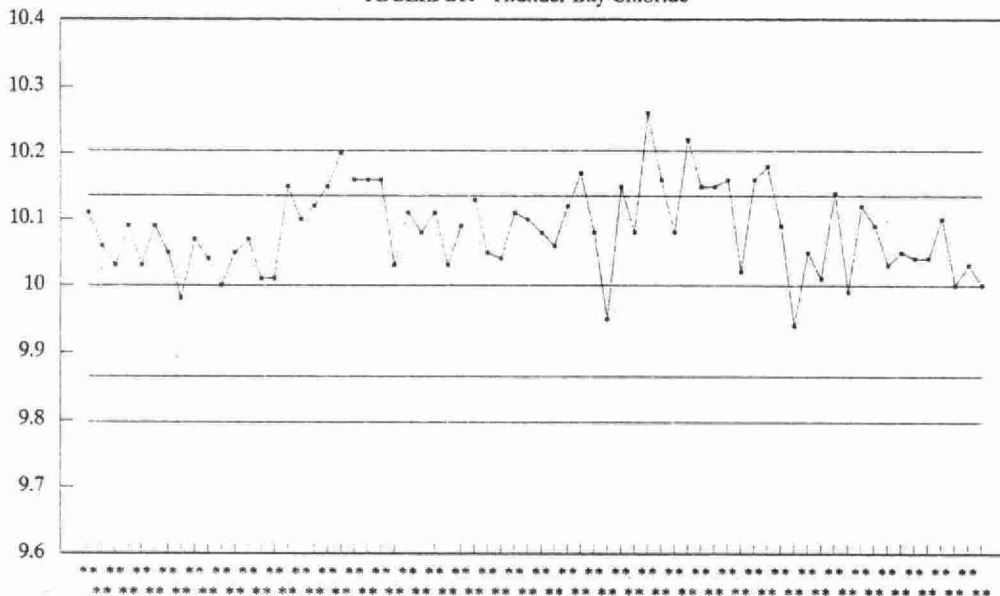


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5008 – 7586

CLIDUR Chloride, Unf. Reactive

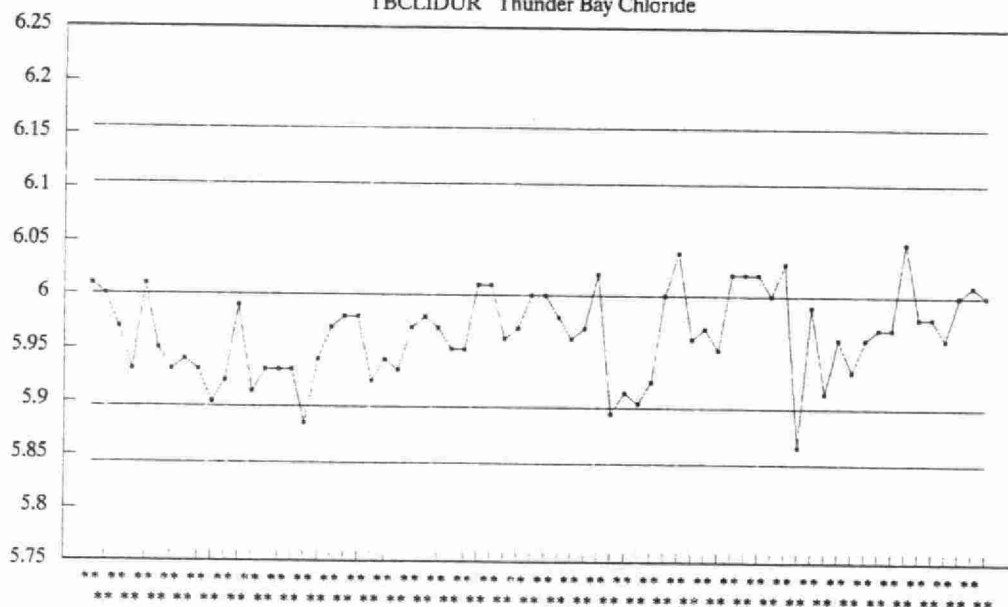
TBCLIDUR Thunder Bay Chloride



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5008 - 7586

CLIDUR Chloride, Unf. Reactive

TBCLIDUR Thunder Bay Chloride



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5008 - 7586

***** CONDUCTIVITY *****

IDENTIFICATION:

LIS Test Name Code: COND25	Introduced	: 1978
Work Station Code : TBCAP	Units	: $\mu\text{S}/\text{cm}$
Method Code : E6003A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, drinking water, ground water, sewage samples, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container	: Glass or PET jar.
Preservative	: Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

A conductivity cell is introduced into a sample at room temperature with continuous stirring. The conductivity is automatically printed out.

NOTE: Total Fixed Endpoint Alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Auto-Titration System, Radiometer, consisting of an ABU80 Autoburette, SAC80 Multisampler, TTT85 Titrator, CDM83 Conductivity Meter and a PRS12 Alpha Printer.

CALIBRATION:

1 Standard for Calibration set, 20 Standards for Calibration check. Calibrated as required.

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift :
Duplicates : DUP (1 every 10 samples)

CAEAL Certified, LRTAP participant

Reporting:	Maximum Significant Figures: Whole Numbers
W Value: 1	T Value: 5

MODIFICATIONS:

1986-Instrumentation changed from Radiometer CDM3
1990-LTB value is now subtracted from QC value.

CONDUCTIVITY

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 2000 uS/cm

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	197	718	717.540	-0.460	3.6622
QCB:	197	147	149.895	2.895	1.3413
QCC:	197	74	75.547	1.547	0.8778
QCA+QCB:	197	865	867.436	2.436	4.4294
QCA-QCB:	197	571	567.645	-3.355	3.2866
QCB+QCC:	197	221	225.442	4.442	1.9892
QCB-QCC:	197	73	74.349	1.349	1.0872

For 1992 Control Charts:

Sw (A-B) = 3.3834

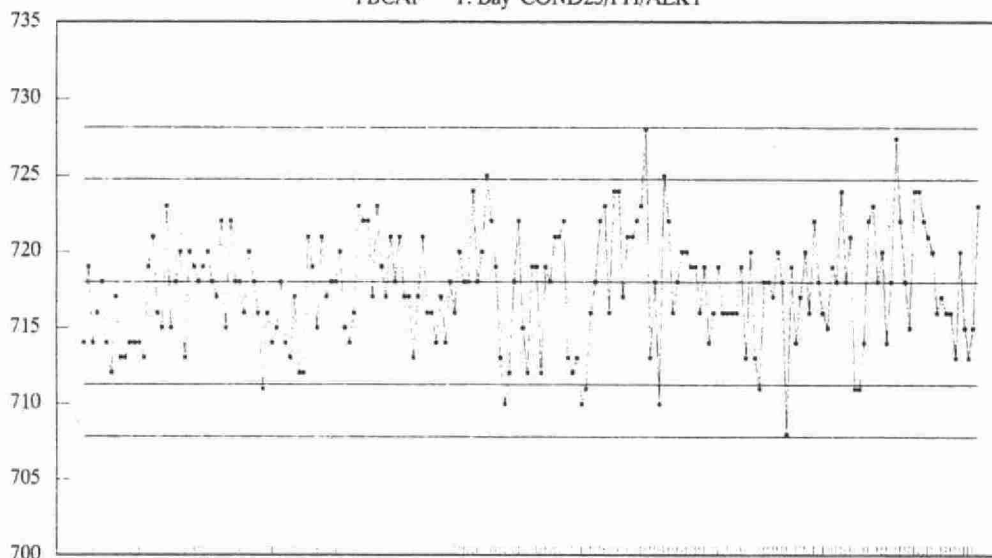
Sw (B-C) = 1.4480

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
385	0 - 400	164.390	1.8892
115	400 - 1000	588.870	5.7604
25	1000 - 2000	1286.920	13.8427

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

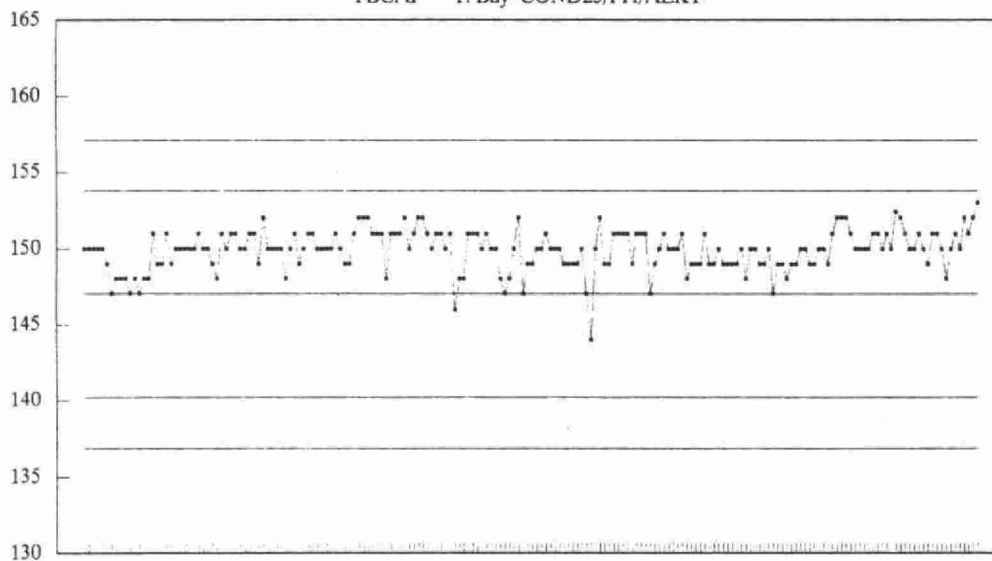


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

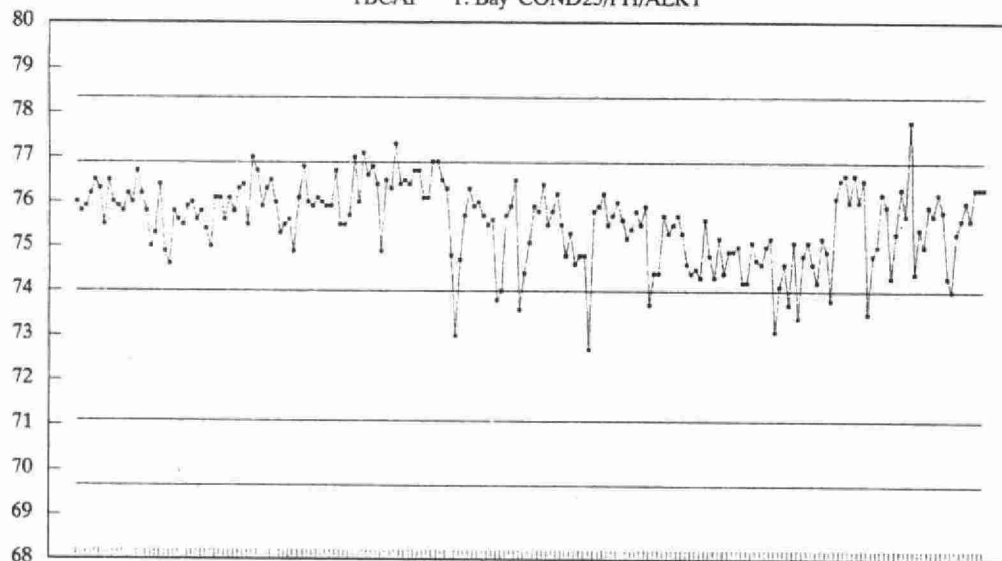


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

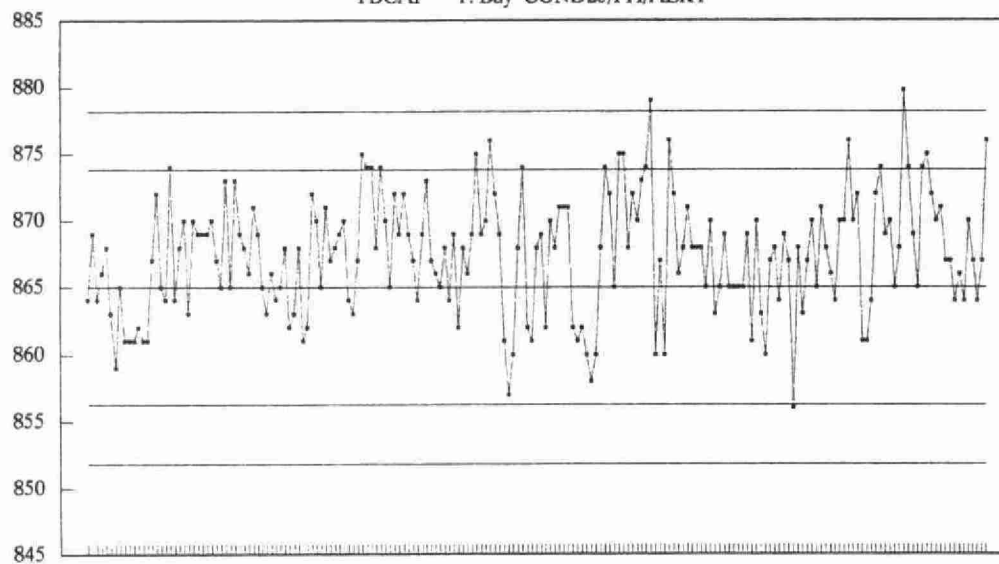


— QCC

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

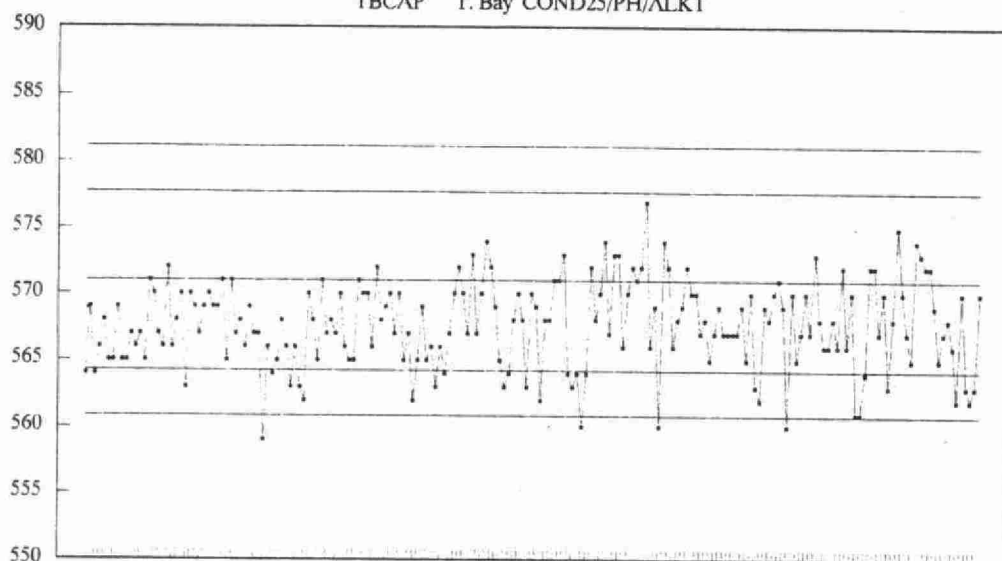


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

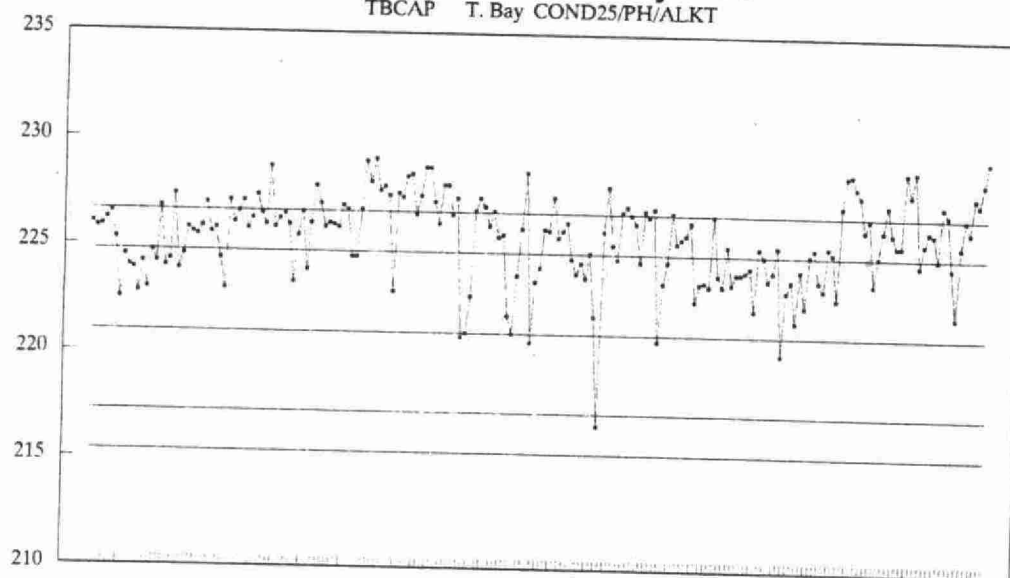


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

— QCA-QCB

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT

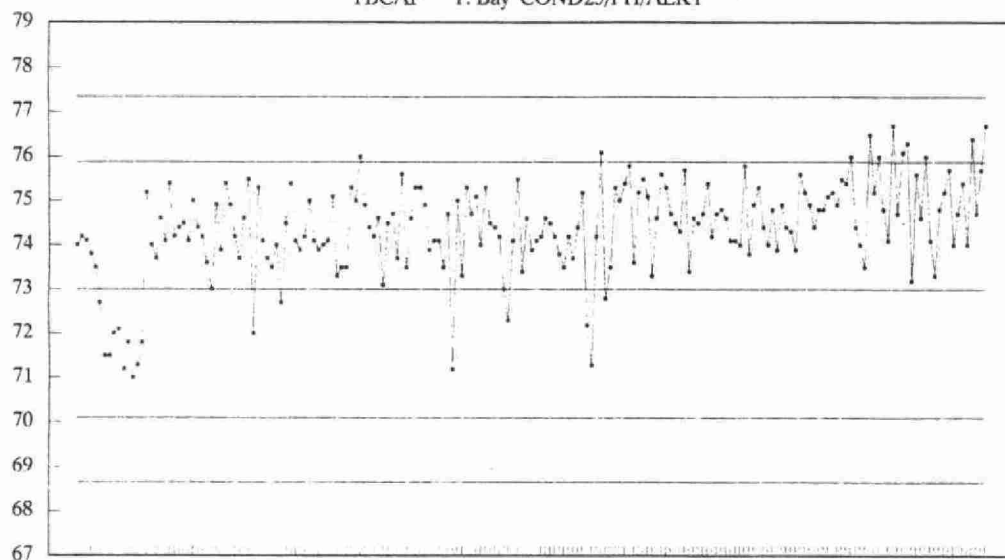


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

— QCB+QCC

COND25 Conductivity 25C

TBCAP T. Bay COND25/PH/ALKT



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

← QCB-QCC

***** CONDUCTIVITY - CDM3 *****

IDENTIFICATION:

LIS Test Name Code:	CDM3	Introduced	: May, 1977
Work Station Code :	TBCOND25	Units	: $\mu\text{S}/\text{cm}$
Method Code	: E6005A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, drinking water, ground water, sewage samples, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Sample is introduced into a jacketed conductivity cell and equilibrated to 25°C. The conductivity is read directly off the meter.

INSTRUMENTATION:

Radiometer Conductivity Meter Model CDM3 and a water jacketed cell temperature controlled by a water circulator.

CALIBRATION:

Predetermined cell constant.

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift :
Duplicates : DUP (1 every 10 samples)

Reporting: Maximum Significant Figures: Whole Numbers
W Value: 1 T Value: 5

CONDUCTIVITY – CDM3

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 1000 uS/cm

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	9	718	717.222	-0.778	0.9718
QCB:	9	147	142.889	-4.111	2.1474
QCC:	9	74	75.111	1.111	1.1667
QCA+QCB:	9	865	860.111	-4.889	2.7588
QCA-QCB:	9	571	574.333	3.333	1.8708
QCB+QCC:	9	221	218.000	-3.000	3.1225
QCB-QCC:	9	73	67.778	-5.222	1.4814

For 1992 Control Charts:

Sw (A-B) = 4.2980

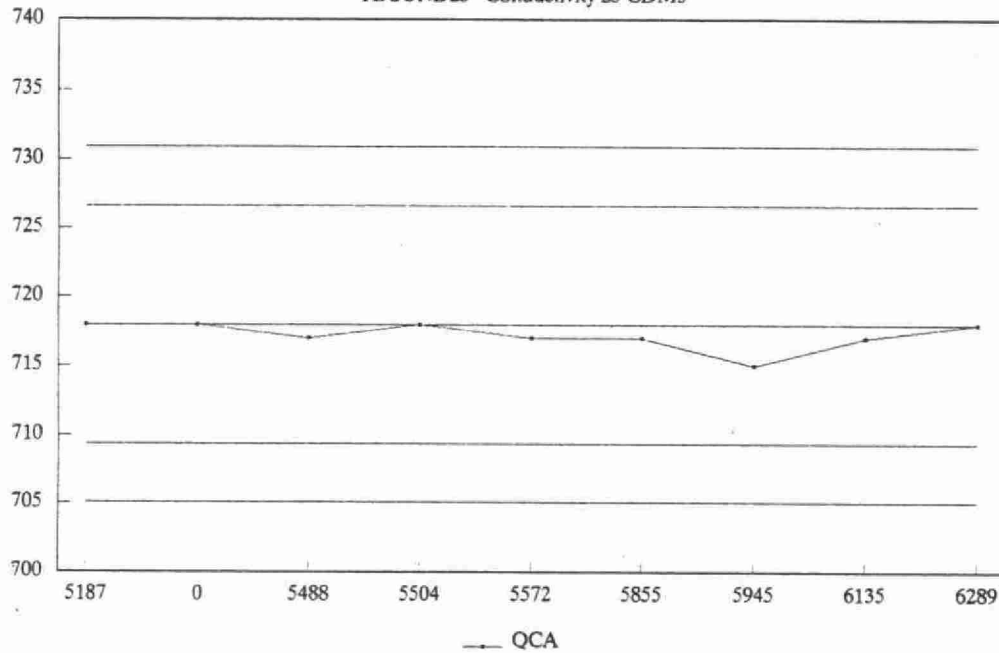
Sw (B-C) = 1.8684

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
1	0 - 200	122	0.7071
4	200 - 500	342.5	1.7678
0	500 - 1000	0	0.0000

CDM3 Conductivity 25C CDM3

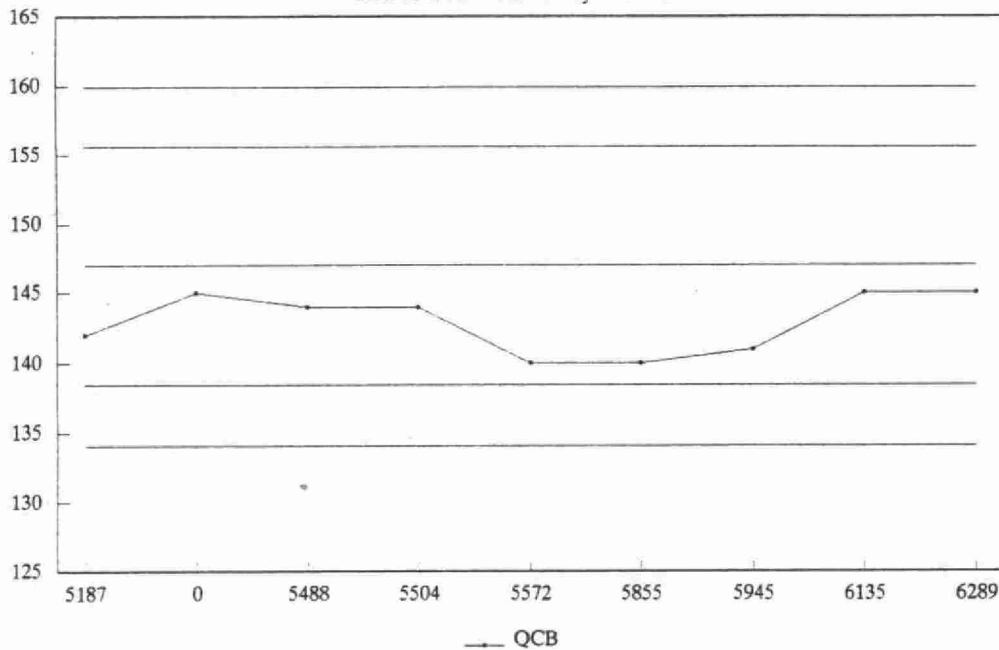
TBCOND25 Conductivity 25 CDM3



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

CDM3 Conductivity 25C CDM3

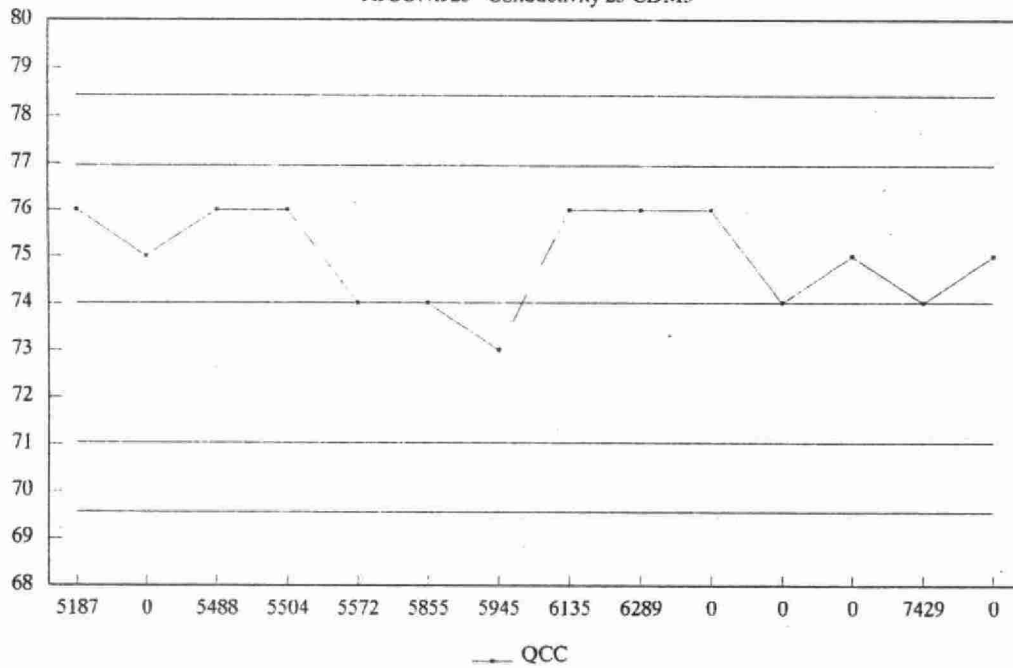
TBCOND25 Conductivity 25 CDM3



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

CDM3 Conductivity 25C CDM3

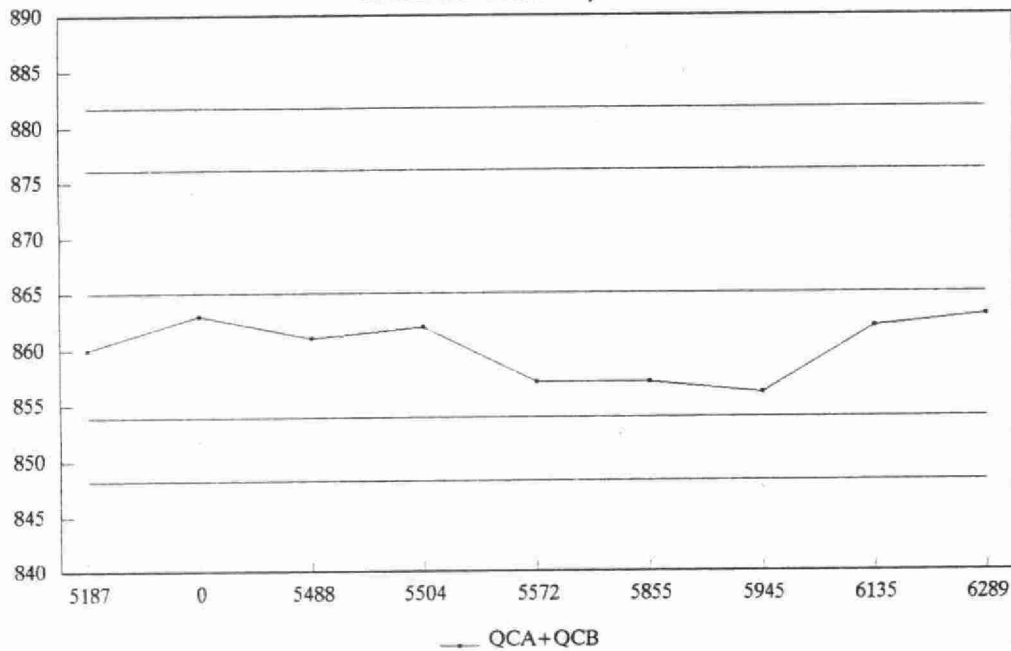
TBCOND25 Conductivity 25 CDM3



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 0

CDM3 Conductivity 25C CDM3

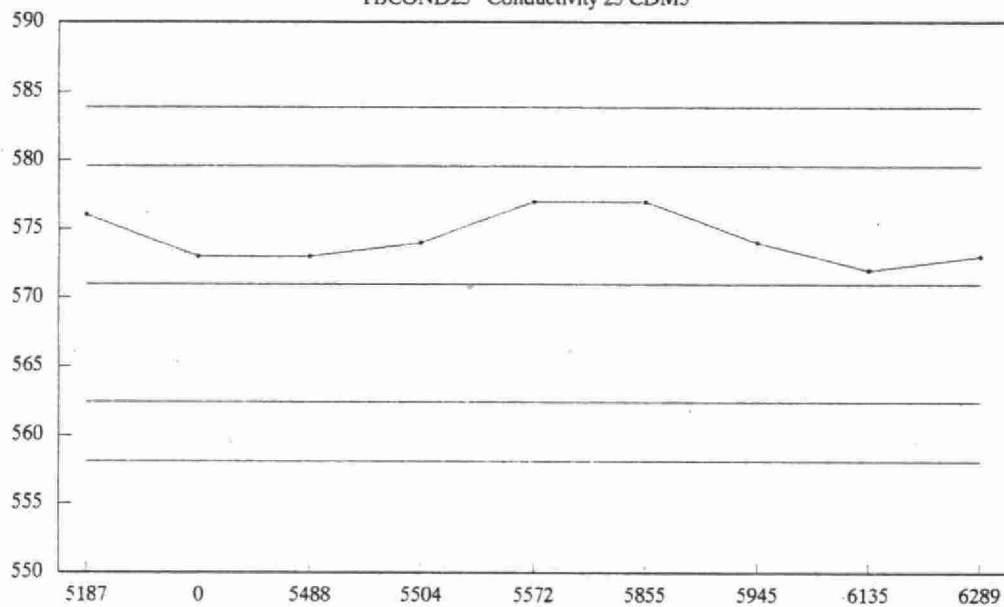
TBCOND25 Conductivity 25 CDM3



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

CDM3 Conductivity 25C CDM3

TBCOND25 Conductivity 25 CDM3

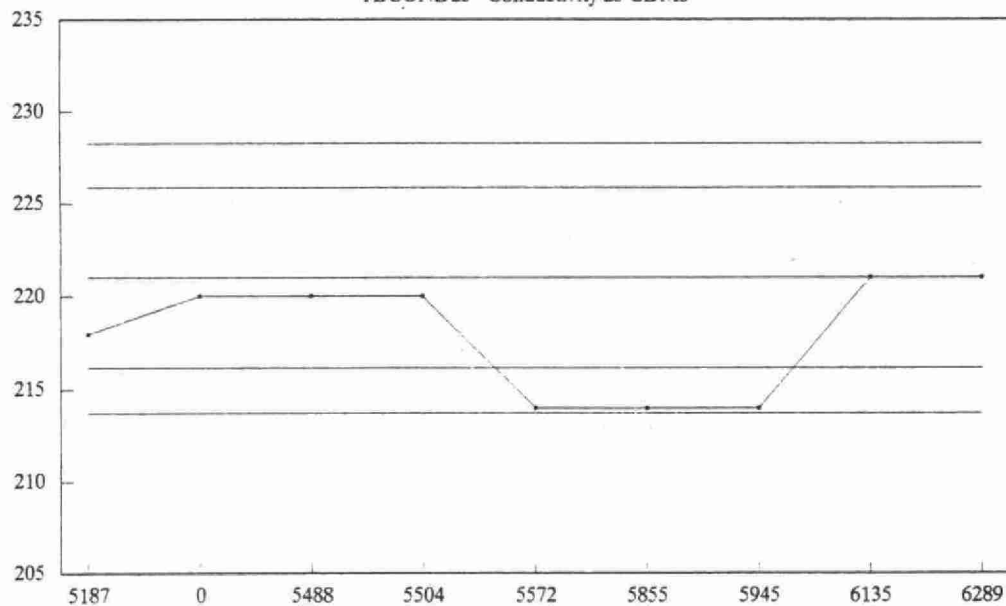


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

QCA-QCB

CDM3 Conductivity 25C CDM3

TBCOND25 Conductivity 25 CDM3

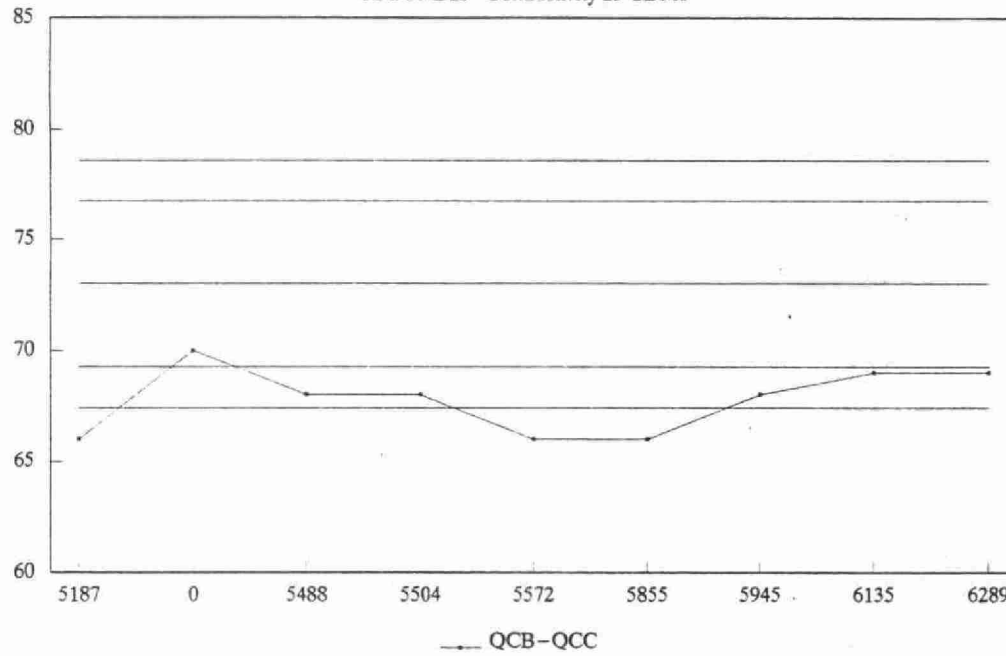


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

QCB+QCC

CDM3 Conductivity 25C CDM3

TBCOND25 Conductivity 25 CDM3



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5187 - 6289

***** FLUORIDE *****

IDENTIFICATION:

LIS Test Name Code: FFIDUR	Introduced	: 1978
Work Station Code : TBFFIDUR	Units	: mg/L as F
Method Code : E6007A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, precipitation and landfill leachates.

SAMPLING:

Special Instructions: No glass bottles if high level expected.
Container : PET or glass
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Fluoride is determined by an ion specific electrode. Any complexed fluoride in the sample is dissociated by the addition of a Total Ionic Strength Adjustment Buffer (TISAB).

INSTRUMENTATION:

Radiometer Ion85 Ion Analyzer, with SAC80 Automated Sample Changer.

CALIBRATION:

- Logarithmic
- 5 Standards 0.1 - 2.0 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB
Drift : 0.2 and 2.0 mg/l standards every 20 samples
Duplicates : 1 for every 15 samples, run at beginning

Reporting : Maximum Significant Figures: 2
W Value: .01 T Value: .05

CAEAL Certified, LRTAP and QM Blind Audit participants

MODIFICATIONS:

April 1988- The method was changed to the present automated system from an Ion Specific electrode and pH/Ion meter.

FLUORIDE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 2 mg/L as F

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	55	1.4	1.406	0.006	0.0239
QCB:	55	0.4	0.406	0.006	0.0254
QCA+QCB:	55	1.8	1.811	0.011	0.0385
QCA-QCB:	55	1.0	1.000	0.000	0.0309

For 1992 Control Charts:

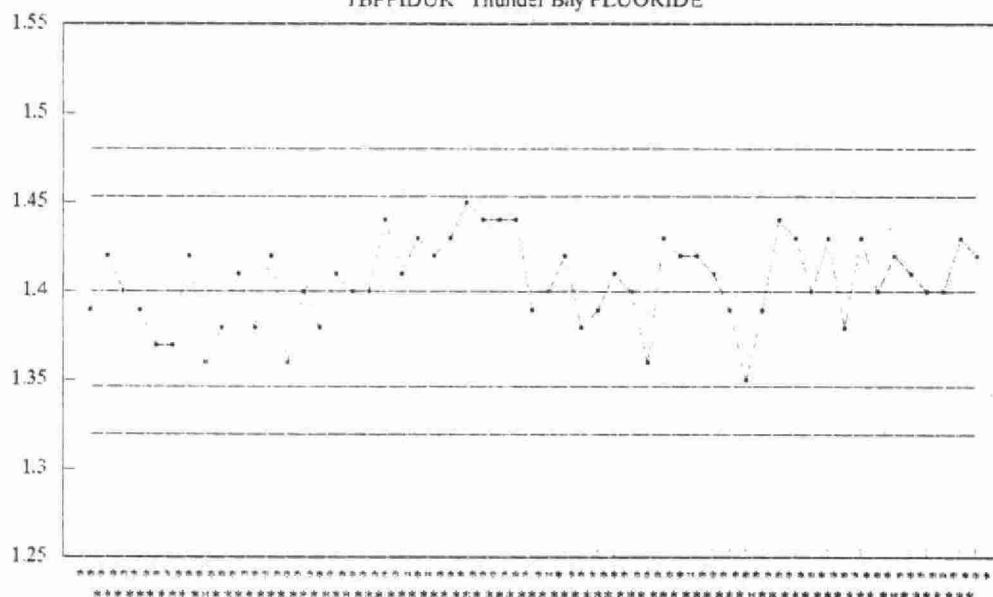
$$Sw (A-B) = 0.0268$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
115	0.0 – 0.4	0.131	0.0220
24	0.4 – 1.0	0.758	0.0461
16	1.0 – 2.0	1.260	0.0436

FFIDUR FLUORIDE, Unf. Reactive

TBFFIDUR Thunder Bay FLUORIDE

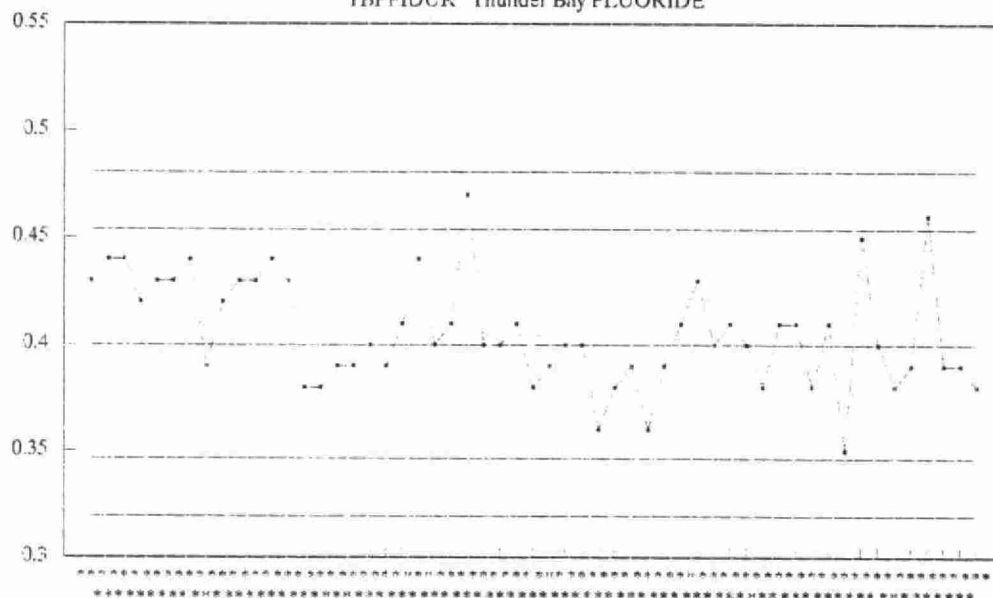


QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5015 - 7634

FFIDUR FLUORIDE, Unf. Reactive

TBFFIDUR Thunder Bay FLUORIDE

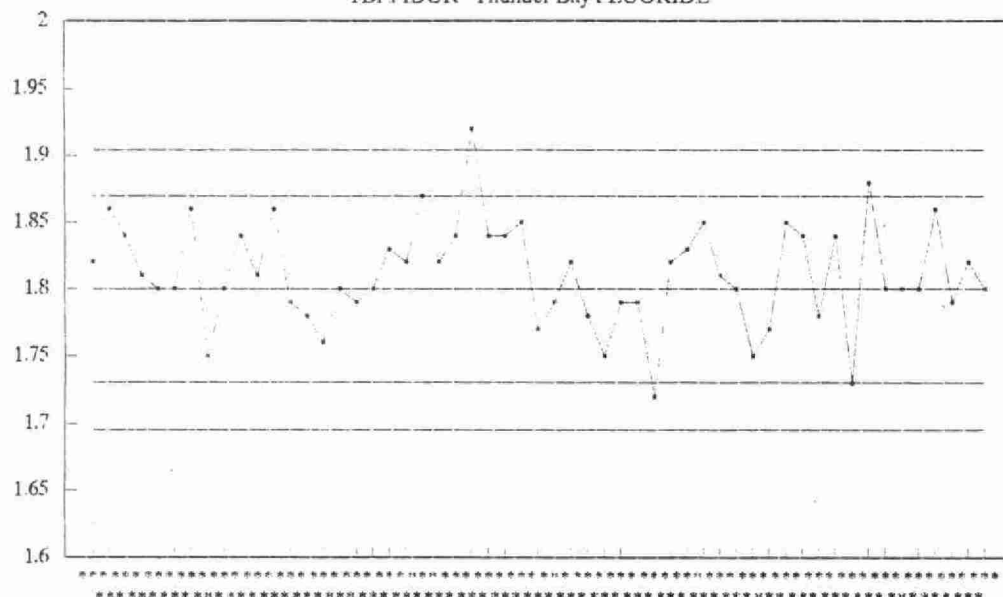


QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5015 - 7634

FFIDUR FLUORIDE, Unf. Reactive

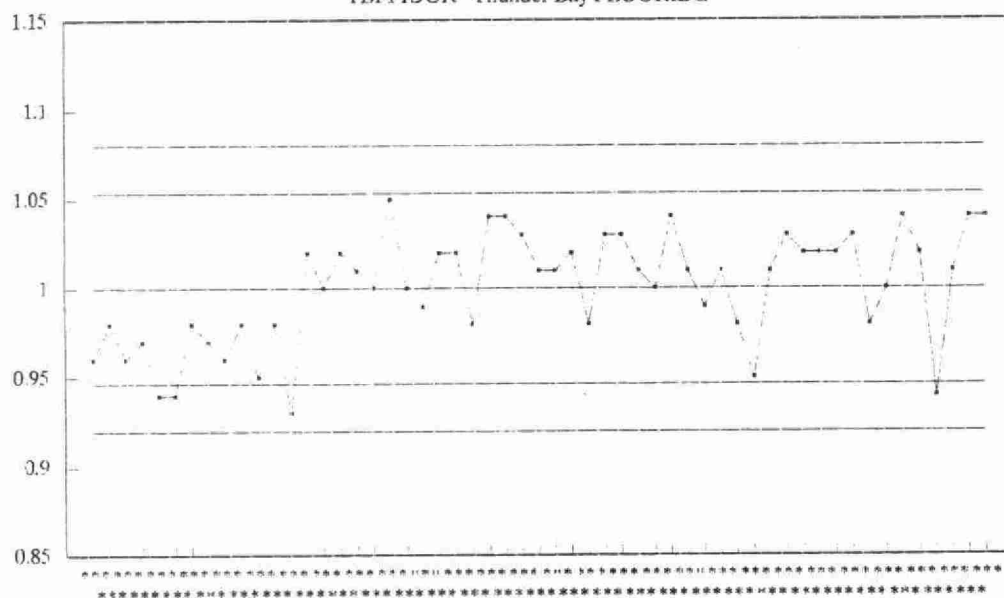
TBFFIDUR Thunder Bay FLUORIDE



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5015 - 7634

FFIDUR FLUORIDE, Unf. Reactive

TBFFIDUR Thunder Bay FLUORIDE



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5015 - 7634

***** HARDNESS *****

IDENTIFICATION:

LIS Test Name Code: HARDT	Introduced	: May, 1981
Work Station Code : TBHARD	Units	: mg/L as CaCO ₃
Method Code : E6008A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container	: Glass or PET jar.
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

A manual titrimetric method is used where Erichrome Black T is added to an aliquot of sample and is buffered to pH 10. The resulting wine-red coloured solution is then titrated with EDTA, a chelating agent, to a blue end-point.

INSTRUMENTATION:

Brinkmann Auto-Burette with digital display.

CALIBRATION:

- EDTA standardized with Calcium Carbonate Standard Solution

CONTROLS AND QUALITY ASSURANCE:

Calibration: QCA, QCB
Drift :
Duplicates : DUP (1 per 20 samples)

Reporting:	Maximum Significant Figures: 2
	W Value: .5 T Value: 2.5

MODIFICATIONS:

May, 1986 - A digital burette was incorporated.

HARDNESS

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 200mg/L as CaCO₃

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	103	50	50.155	0.155	0.7661
QCB:	103	25	25.067	0.067	0.7254
QCA+QCB:	103	75	75.222	0.222	1.2884
QCA-QCB:	103	25	25.088	0.088	0.7525

For 1992 Control Charts:

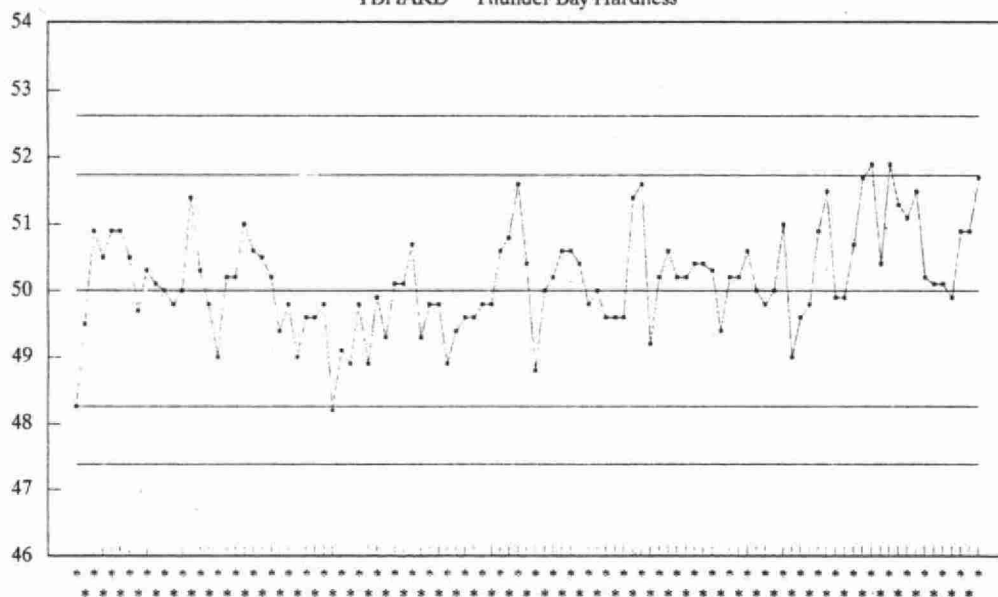
$$Sw (A-B) = 0.8714$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
95	0 – 40	19.858	1.5544
93	40 – 100	64.634	1.4387
56	100 – 200	148.643	3.1932

HARDT Hardness Total

TBHARD Thunder Bay Hardness

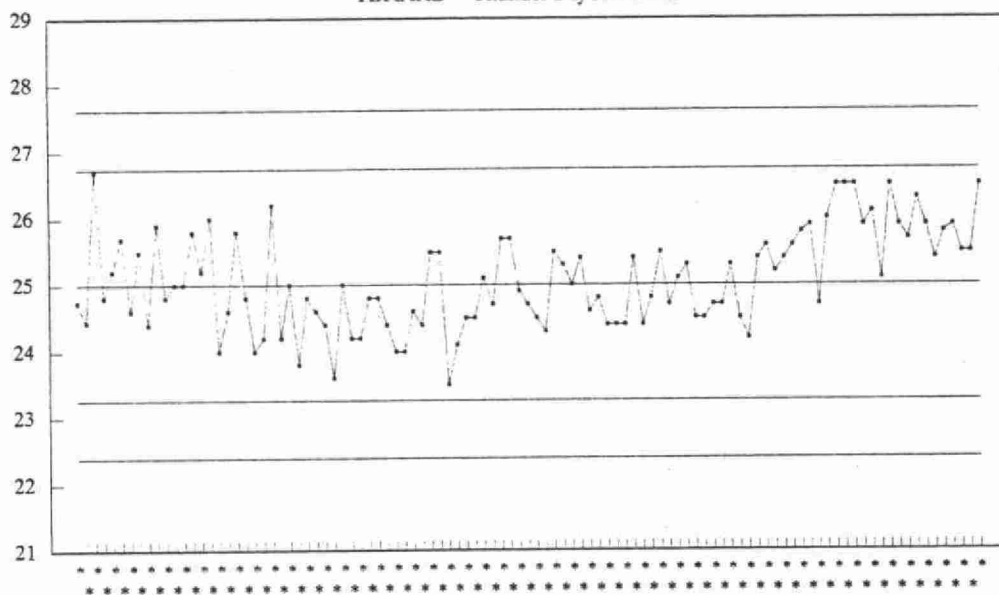


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5009 – 7659

HARDT Hardness Total

TBHARD Thunder Bay Hardness

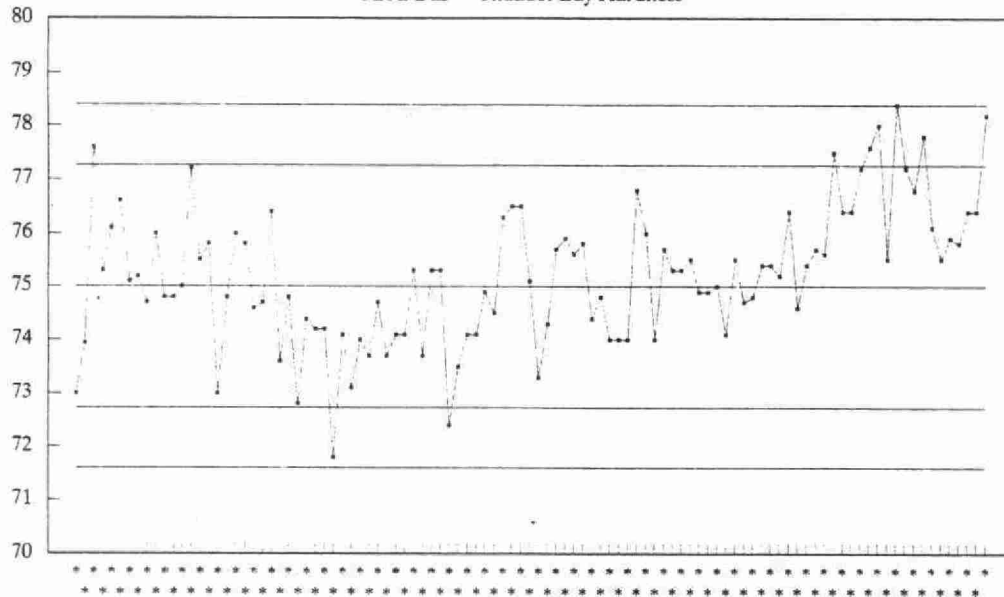


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5009 – 7659

HARDT Hardness Total

TBHARD Thunder Bay Hardness

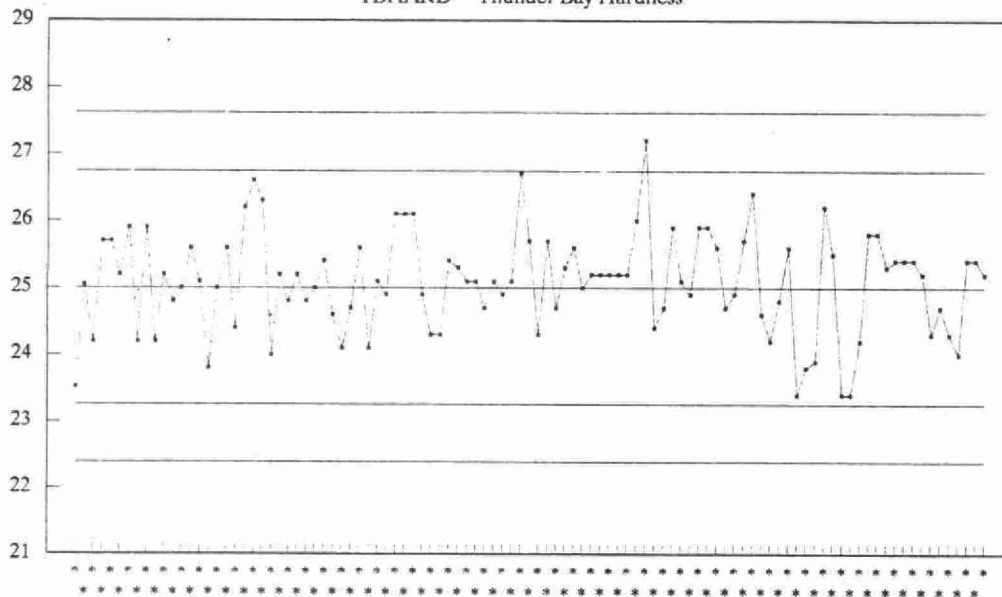


—•— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5009 – 7659

HARDT Hardness Total

TBHARD Thunder Bay Hardness



—•— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5009 – 7659

***** IRON - COLOURMETRIC *****

IDENTIFICATION:

LIS Test Name Code: FEUTW	Introduced	: May, 1978
Work Station Code : TBFEUTW	Unit	: mg/L as Fe
Method Code : E6006A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, ground water and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

An aliquot of sample, usually 50 mls is mixed with an acidified hydroxylamine hydrochloride solution and concentrated. Ortho-phenanthroline and a buffer are added causing a colour development. The coloured solution formed obeys Beer's Law and its intensity is measured using a spectrophotometer.

INSTRUMENTATION:

Spectronic 20, set at a wavelength of 510 nm.

CALIBRATION:

- Linear
- 10 Standards, .20 - 2.00 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: DIG. BLANKS, QCA, QCB, QCC
Drift : 100 %T check DDW, ZERO %T check every 10 samples
Duplicates : DUP (1 per 10 samples)

Reporting: Maximum Significant Figures: 2
W Value: 0.01 T Value: 0.05

IRON – COLOURMETRIC

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 2 mg/L as Fe

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	53	1	1.007	0.007	0.0202
QCB:	53	0.2	0.189	-0.011	0.0156
QCA+QCB:	53	1.2	1.196	-0.004	0.0305
QCA-QCB:	53	0.8	0.818	0.018	0.0193

For 1992 Control Charts:

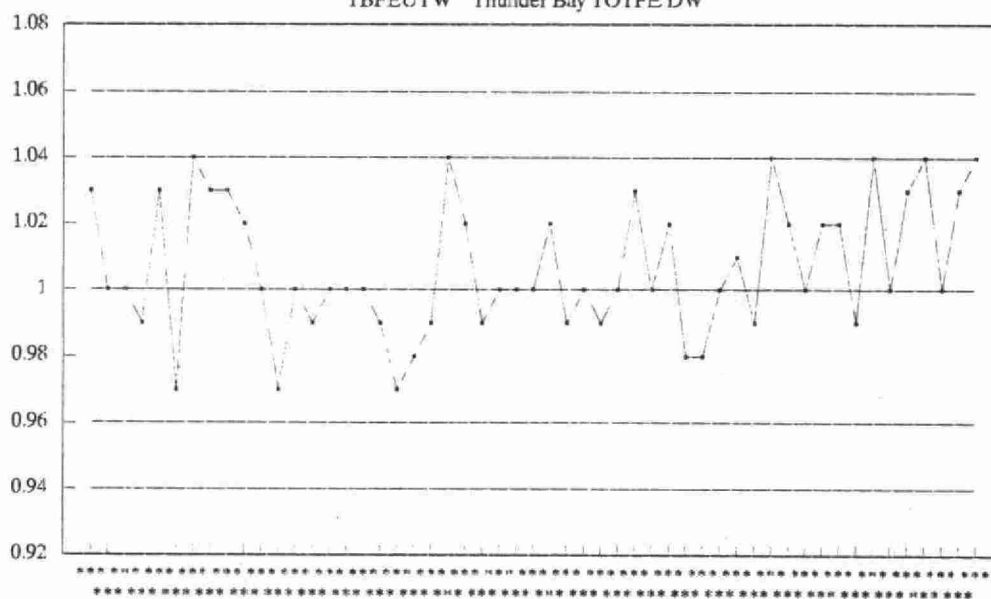
$$Sw (A-B) = 0.0200$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
106	0.0 – 0.4	0.092	0.0106
11	0.4 – 1.0	0.631	0.0433
6	1.0 – 2.0	1.260	0.0029

FEUTW Iron Dig. Colourmetric

TBFEUTW Thunder Bay TOTFE DW

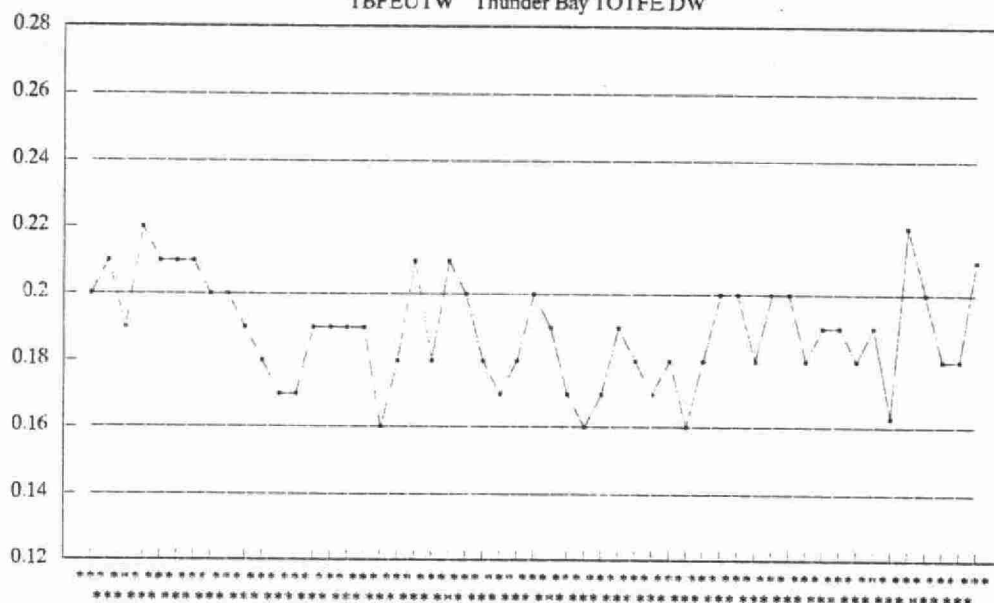


— QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5029 - 7647

FEUTW Iron Dig. Colourmetric

TBFEUTW Thunder Bay TOTFE DW

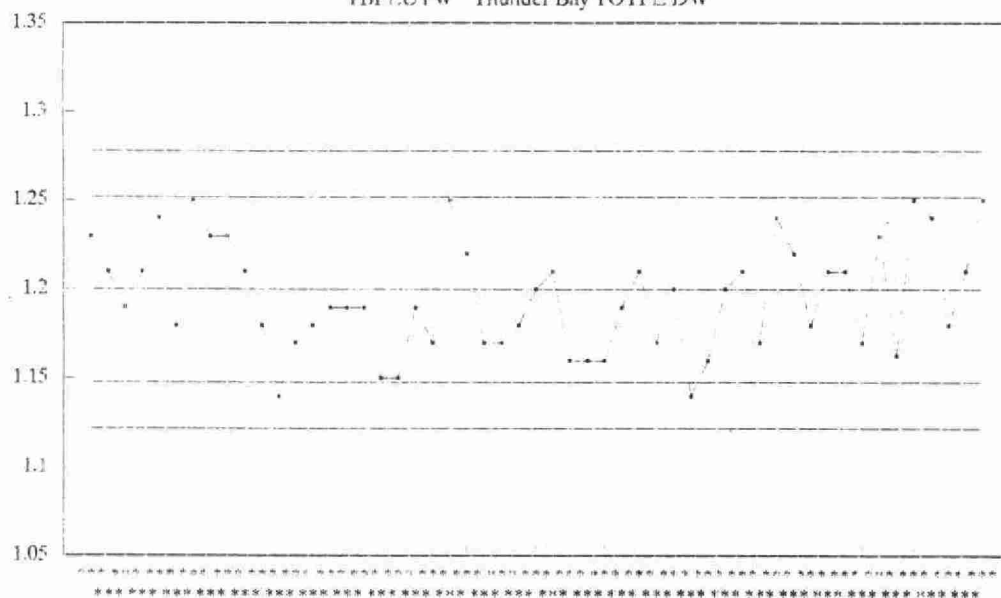


— QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5029 - 7647

FEUTW Iron Dig. Colourmetric

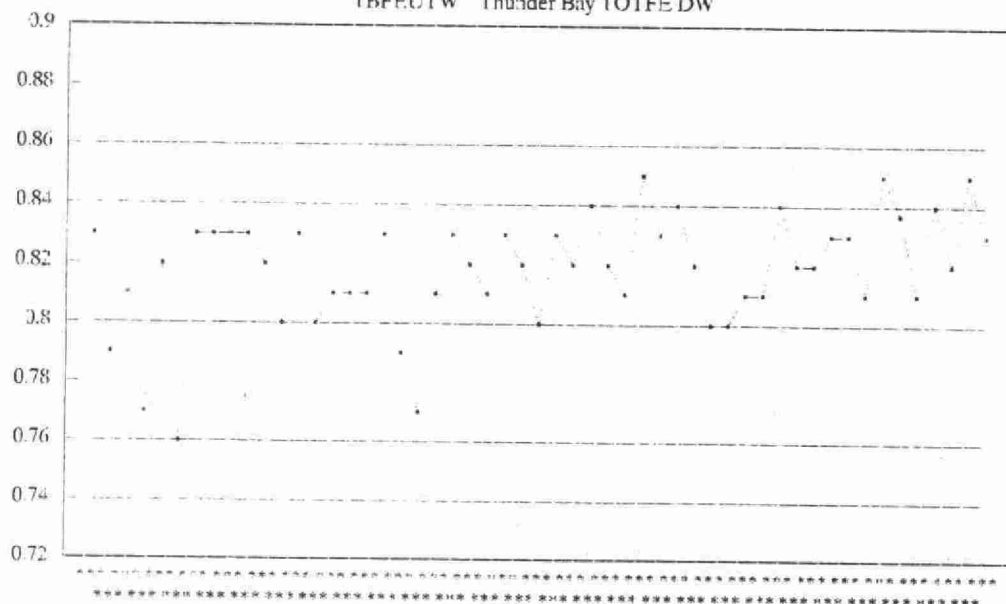
TBFEUTW Thunder Bay TOTFE DW



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5029 - 7647

FEUTW Iron Dig. Colourmetric

TBFEUTW Thunder Bay TOTFE DW



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5029 - 7647

***** NITRATE *****

IDENTIFICATION:

LIS Test Name Code: NNO3FR	Introduced	: 1978
Work Station Code : TBNDNP	Units	: mg/L as N
Method Code : E6024A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Nitrate is reduced to nitrite by heating an aliquot of sample with hydrazine in alkaline media; this reaction is catalyzed by the addition of cupric ion. Subsequently, an azo dye is formed in acid media by diazotizing sulphanilamide with nitrite and coupling the product with N(1-naphthyl) ethylenediamine dihydrochloride. The nitrite result is subtracted from this nitrate plus nitrite reaction.

N.B. Ammonia, nitrite and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI with a 37°C heating bath. Colourimetric measurement is through a 5.0 cm. light path at 520 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 0.50 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC

Drift : BLK every 10 samples, CHK (100%) every 20 samples

Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: 0.01 T Value: 0.05

CAEAL Certified, LRTAP and QM Blind Audit participant

MODIFICATIONS:

1988 - All channels went to microcomputer control with DCI software.

NITRATE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 0.5 mg/L as N

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	74	0.320	0.324	0.004	0.0046
QCB:	74	0.800	0.081	-0.719	0.0026
QCC:	74	0.032	0.032	0.000	0.0023
QCA+QCB:	74	0.400	0.406	0.006	0.0063
QCA-QCB:	74	0.240	0.243	0.003	0.0040
QCB+QCC:	74	0.112	0.114	0.002	0.0045
QCB-QCC:	74	0.048	0.049	0.001	0.0022

For 1992 Control Charts:

Sw (A-B) = 0.0034

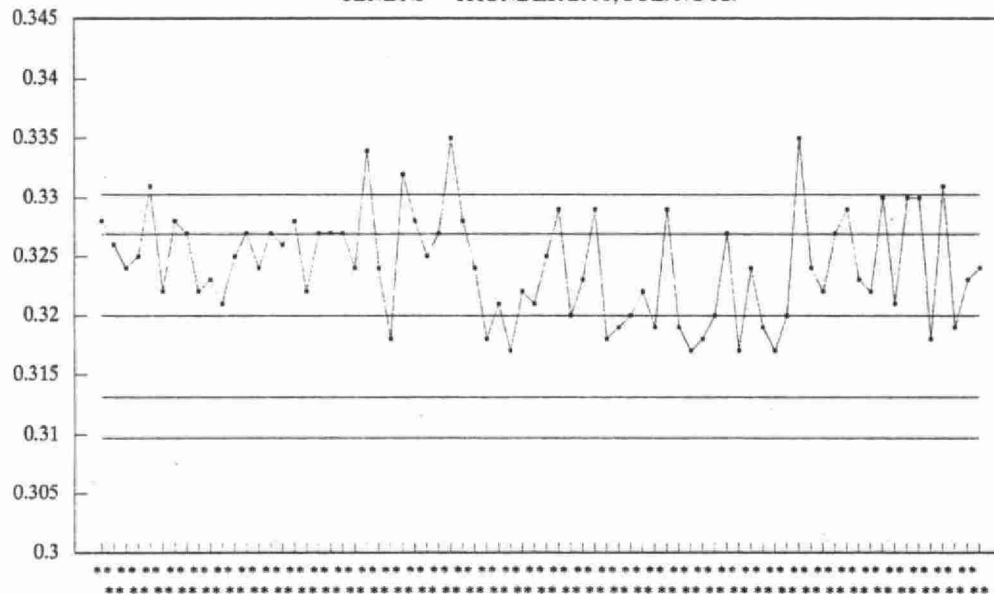
Sw (B-C) = 0.0027

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
121	0.00 – 0.10	0.018	0.0037
42	0.10 – 0.25	0.171	0.0059
21	0.25 – 0.50	0.319	0.0065

NNO3FR Nitrate, Frac.React.

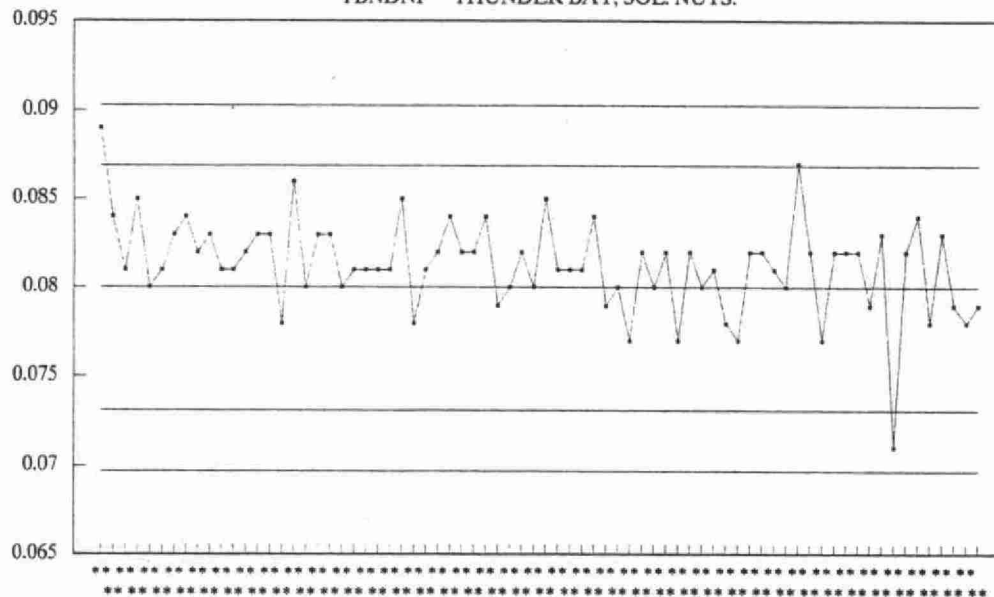
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
 Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

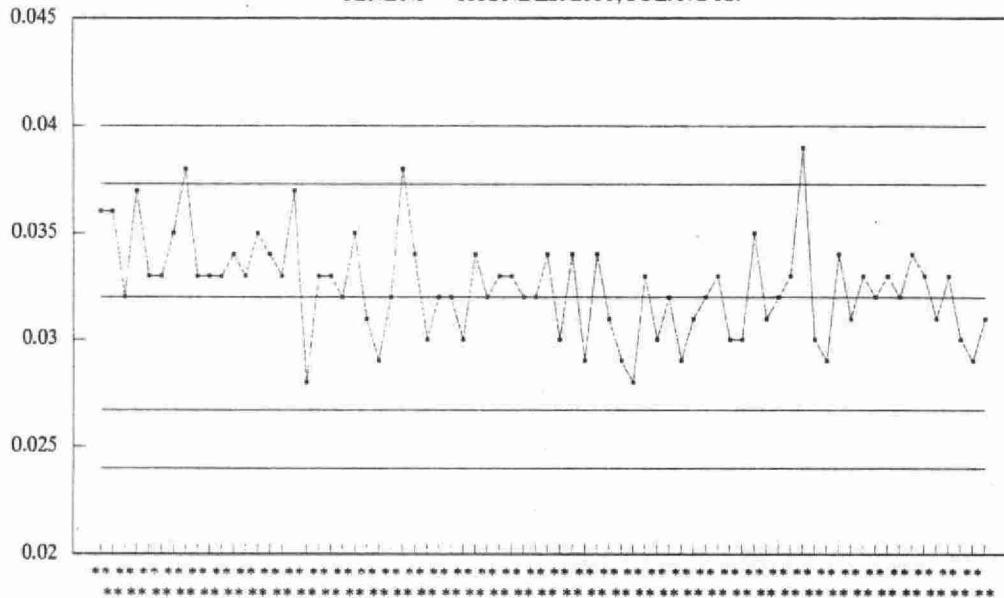
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
 Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.

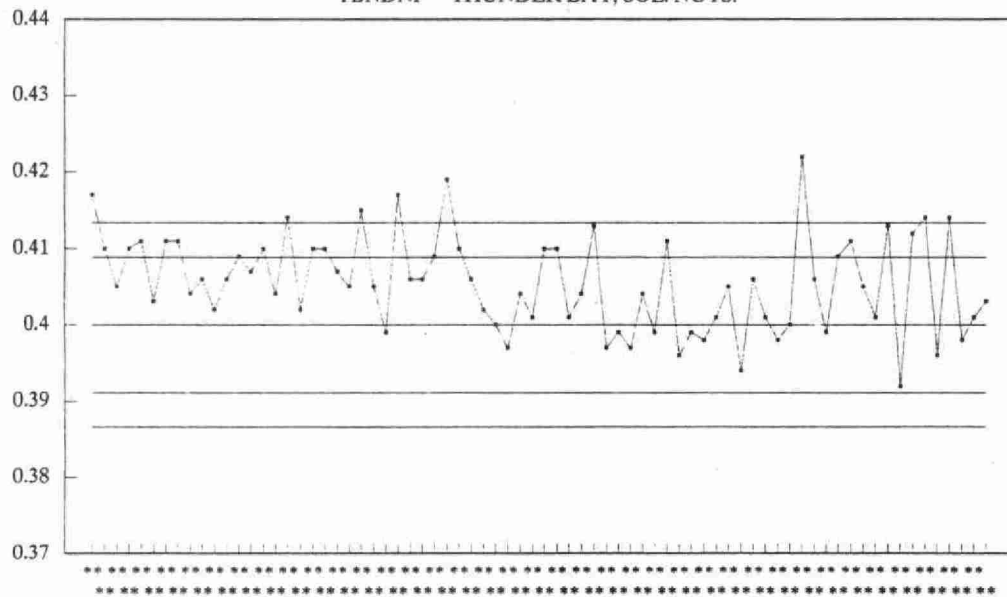


— QCC

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.

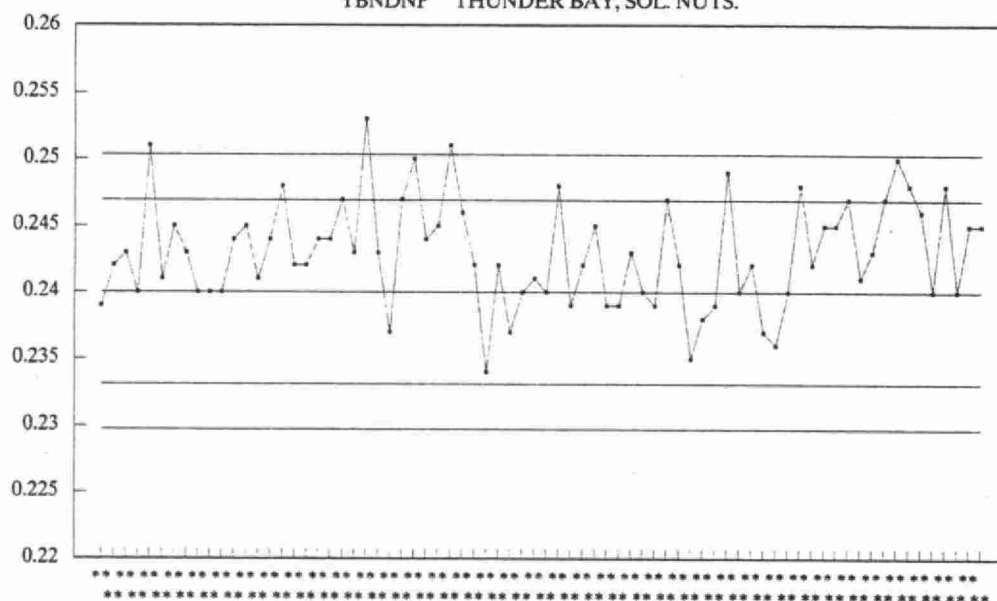


— QCA+QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

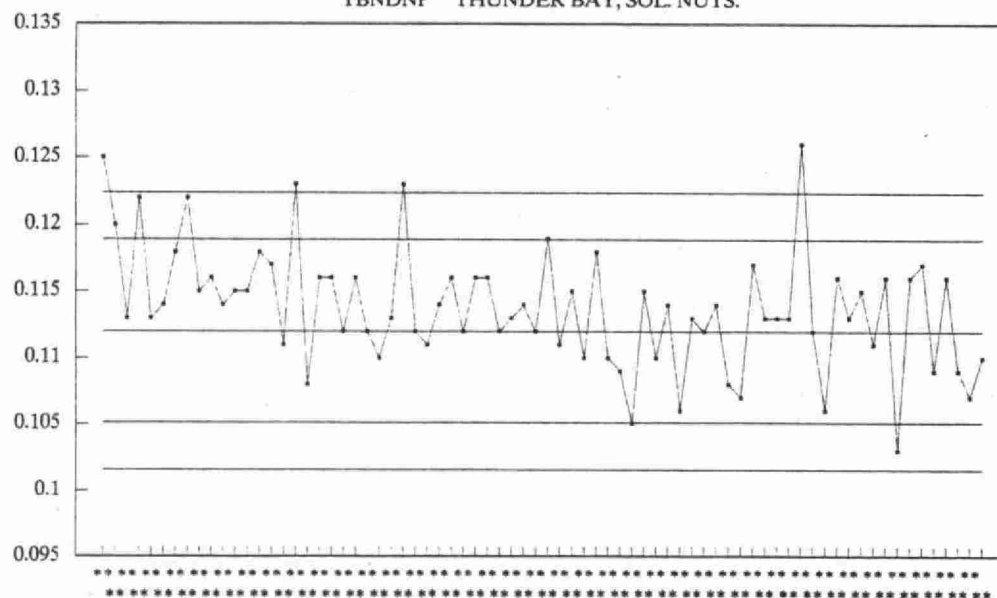
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

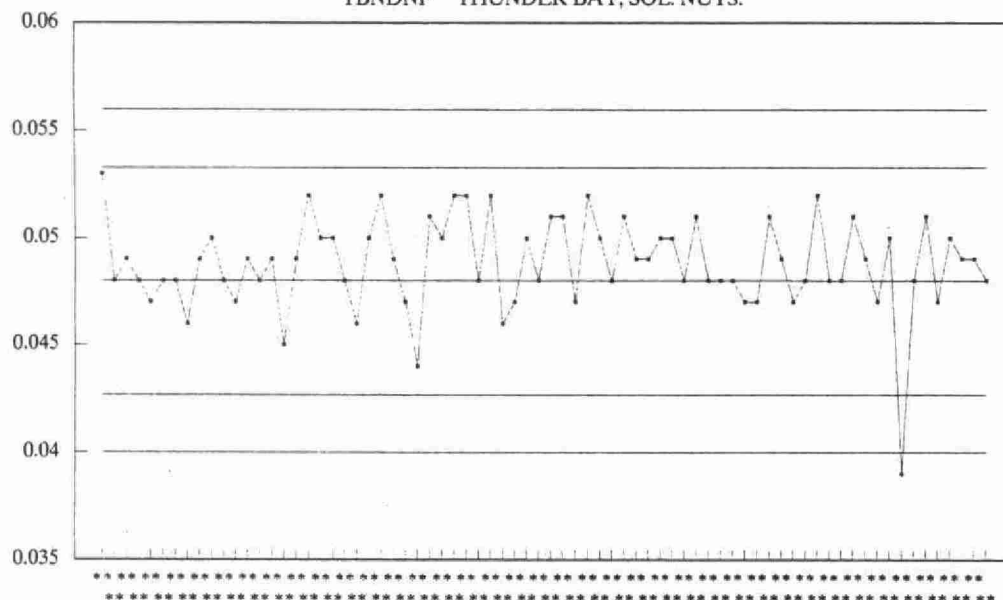
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO3FR Nitrate, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

— QCB-QCC

***** NITRITE *****

IDENTIFICATION:

LIS Test Name Code: NNO2FR	Introduced	: 1978
Work Station Code : TBNDNP	Units	: mg/L as N
Method Code : E6024A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Nitrite forms a diazotization product with sulphanilamide which is then coupled with N(1-naphthyl) ethylenediamine dihydrochloride at pH 1. A light red colour is produced and the absorbance of the solution is measured at 520 nm.

N.B. Ammonia, nitrate plus nitrite and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI. Colourimetric measurement is through a 5.0 cm. light path at 520 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 0.10 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift : BLK every 10 samples, CHK (100%) every 20 samples
Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: 0.001 T Value: 0.005

MODIFICATIONS:

1988 - All channels went to microcomputer control with DCI software.

NITRITE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 0.1 mg/L as N

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	74	0.080	0.080	0.00015	0.00066
QCB:	74	0.020	0.020	-0.00012	0.00033
QCC:	74	0.008	0.008	-0.00001	0.00020
QCA+QCB:	74	0.100	0.100	0.00003	0.00086
QCA-QCB:	74	0.060	0.060	0.00027	0.00058
QCB+QCC:	74	0.028	0.028	-0.00013	0.00045
QCB-QCC:	74	0.012	0.012	-0.00011	0.00031

For 1992 Control Charts:

Sw (A-B) = 0.0006

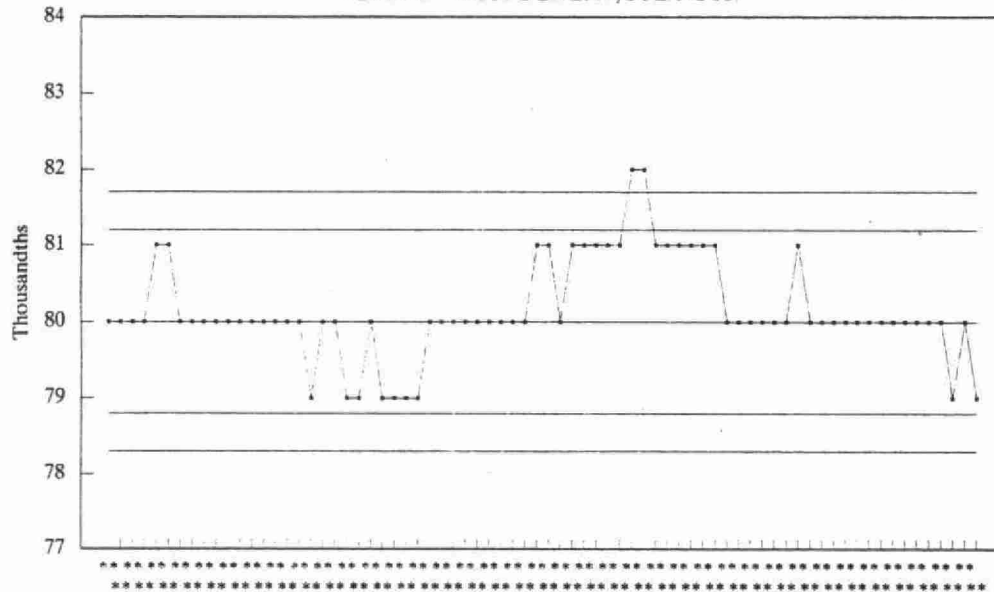
Sw (B-C) = 0.0004

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
200	0.00 – 0.02	0.0025	0.00051
6	0.02 – 0.05	0.0277	0.00050
1	0.05 – 0.10	0.0900	0.00000

NNO2FR NITRITE, Frac.React.

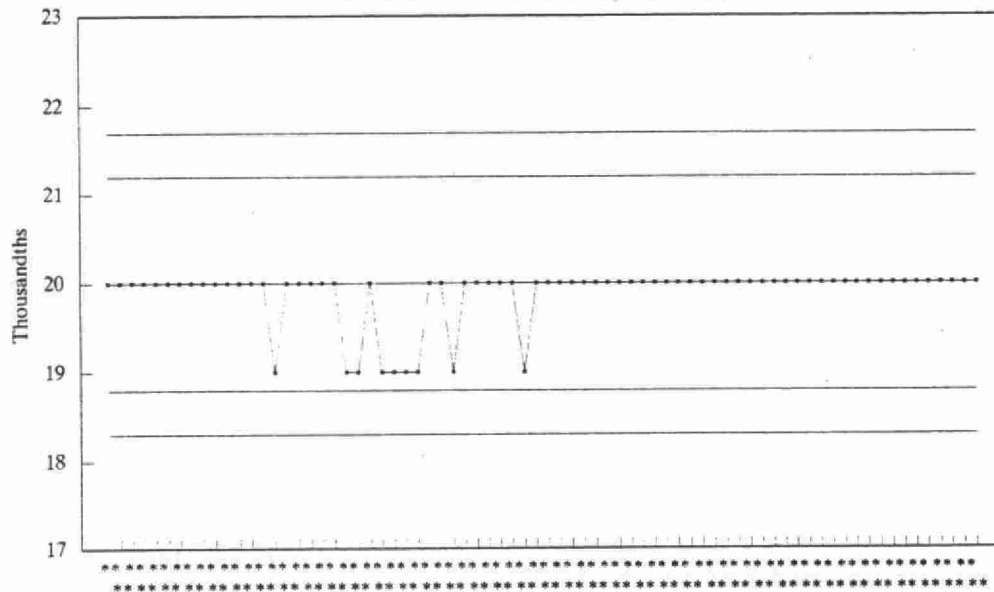
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

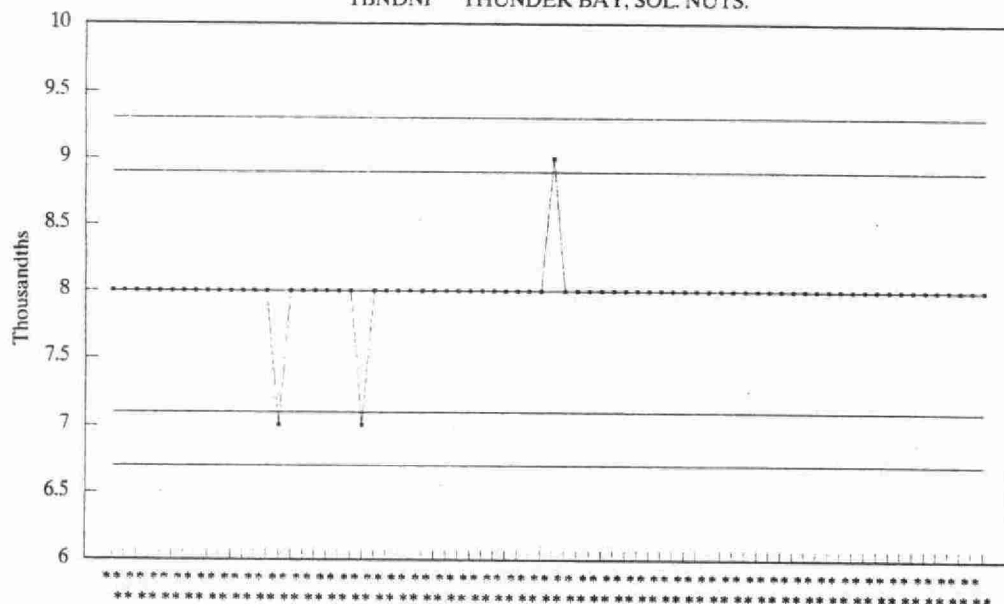
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

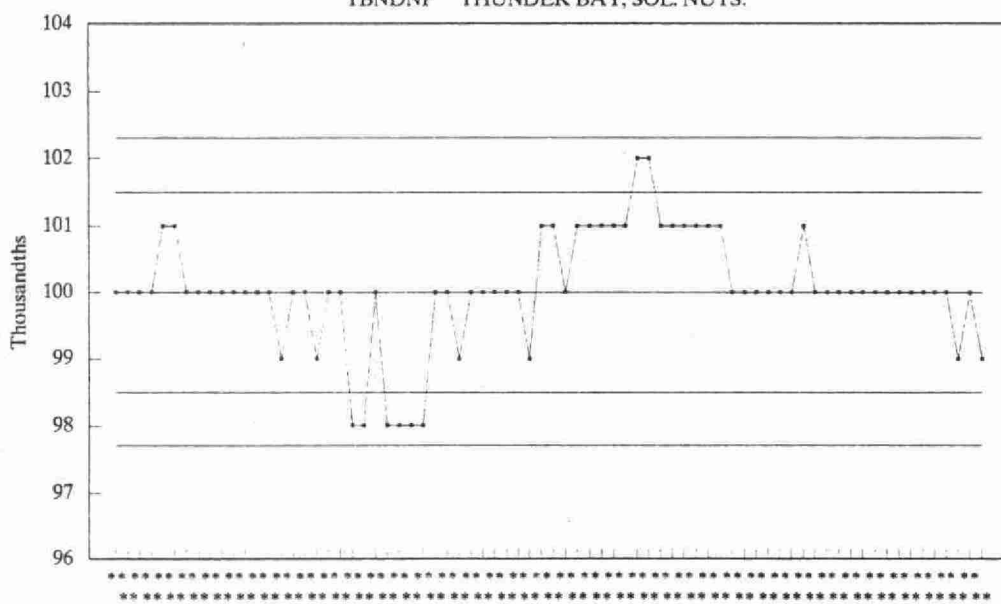
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
 Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

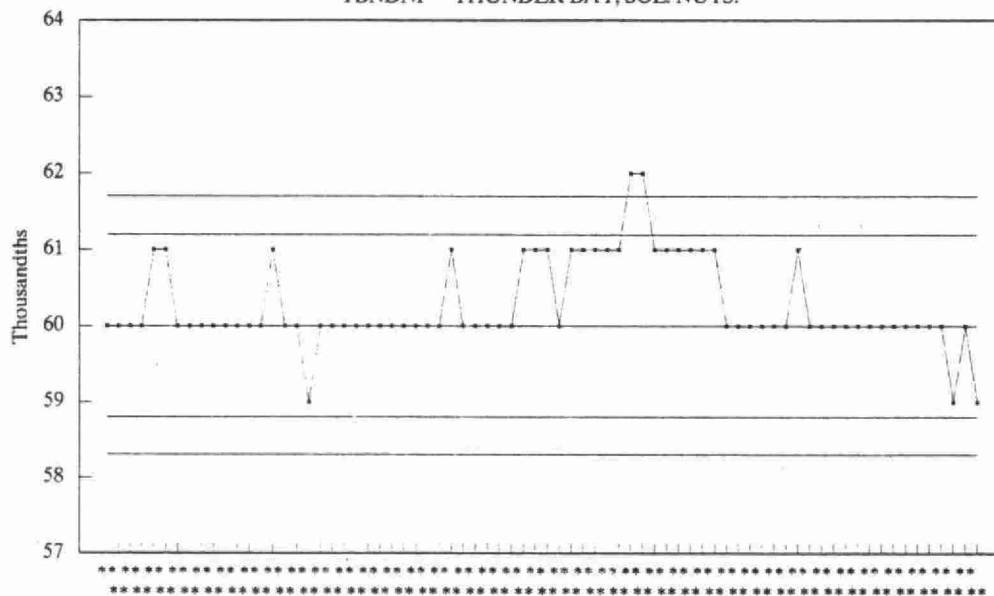
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
 Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

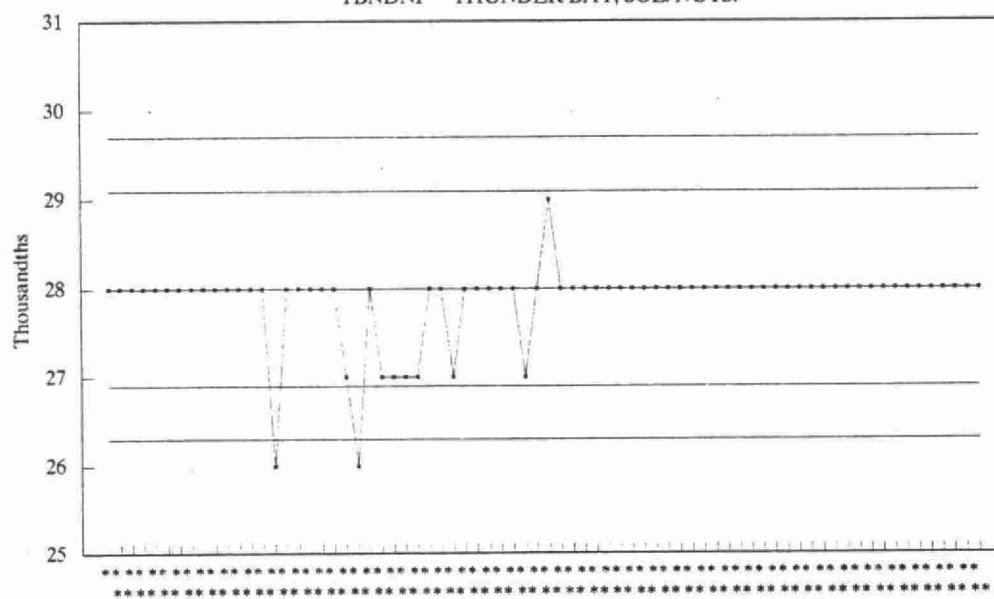
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

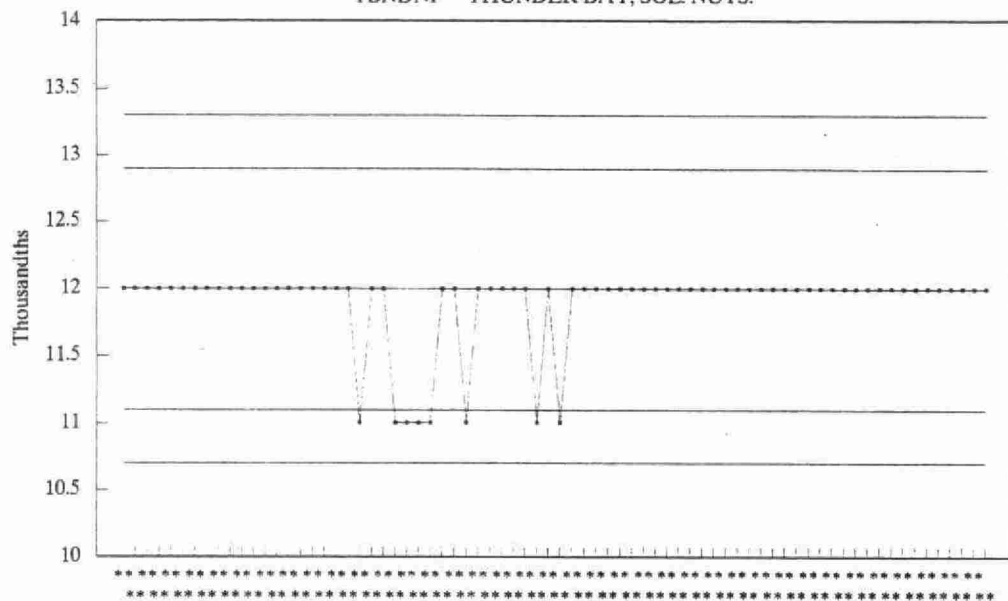
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

NNO2FR NITRITE, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

→ QCB-QCC

***** PARTICULATE SOLIDS - IGNITED *****

IDENTIFICATION:

LIS Test Name Code: RSPA,RSPLOI	Introduced	: 1980
Work Station Code : TBRSI	Units	: mg/L
Method Code : E6029A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewages, precipitation, industrial effluents and landfill leachates.

SAMPLING:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

The procedure for particulate (suspended) solids is followed and the dried residue is ignited at 600°C for one hour in a muffle furnace. The filter paper is transferred to a desiccator to cool. The ignited or ash weight is obtained as the difference between the final ignited weight and the original filter paper weight. The volume used in the ignited calculations is the volume selected for the original suspended solids calculation. Data collection, calculations and transfer of results are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 place), drying oven, muffle furnace, micro-computer system with appropriate software.

CALIBRATION:

- Balance internal calibration, tare

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 S class weights
Drift : Balance zero (auto. checked every 4th measurement)
Duplicates : DUP (1 for every 10 samples)

Reporting:	Maximum Significant Figures: Whole numbers	
Ashed	W Value: 20	T Value: 100
Loss	W Value: 20	T Value: 100

MODIFICATIONS:

September, 1984 - Commodore computer set up for input.
September, 1988 - Direct Computer Input with Commodore computer.
June, 1989 - Microcomputer and in-house Lotus program replaces Commodore computer.

PARTICULATE SOLIDS – IGNITED

Quality Control Data from January 1 to December 31, 1992

DRIED

Analytical Range – to 6000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
21	0 – 1200	181.762	15.1139
34	1200 – 3000	2377.294	38.8445
68	3000 – 6000	4292.750	50.1578

ASHED

Analytical Range – to 4000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
59	0 – 800	385.322	12.9215
64	800 – 2000	1446.078	30.6595
27	2000 – 4000	2615.814	48.5692

LOSS

Analytical Range – to 4000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
21	0 – 800	118.762	8.1824
25	800 – 2000	1547.400	41.0590
77	2000 – 4000	2798.545	45.7506

***** pH *****

IDENTIFICATION:

LIS Test Name Code: PH	Introduced: 1978
Work Station Code : TBCAP	Units : Dimensionless
Method Code : E6003A	Section : Water Quality

SAMPLE TYPE/MATRIX:

Surface waters, drinking water, ground water, sewage effluents, industrial wastes and precipitation samples.

SAMPLING:

Special Instructions:

Container : Glass or PET jars
Preservative : Refrigerate at 4°C

ANALYTICAL PROCEDURE:

pH is measured directly on a stirred sample using a hydrogen ion sensitive glass combination electrode. The meter is calibrated in pH units against buffers of known pH.

NOTE: Total fixed endpoint alkalinity and conductivity are determined simultaneously.

INSTRUMENTATION:

Auto-Titration System, Radiometer, consisting of ABU80 Auto-Burette, SAC80 Multisampler, TTT85 Titrator, CDM83 Conductivity Meter and PRS12 Alpha Printer.

CALIBRATION:

- Two point calibration
- Buffers 6.86 and 4.01

CONTROLS AND QUALITY ASSURANCE:

Calibration: QCA, QCB

Drift : Buffers are re-analyzed periodically

Duplicates : DUP (1 every 10 samples)

LRTAP participant

Reporting: Maximum Decimal Places: 1
W Value: N/A T Value: N/A

MODIFICATIONS:

1986-Instrumentation changed from Fisher pH Meter to present system.

pH**Quality Control Data from January 1 to December 31, 1992**

Analytical Range – to 9

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	201	9.18	9.203	0.023	0.0143
QCB:	201	4.01	4.005	-0.005	0.0110
QCA+QCB:	201	13.19	13.208	0.018	0.0193
QCA-QCB:	201	5.17	5.197	0.027	0.0167

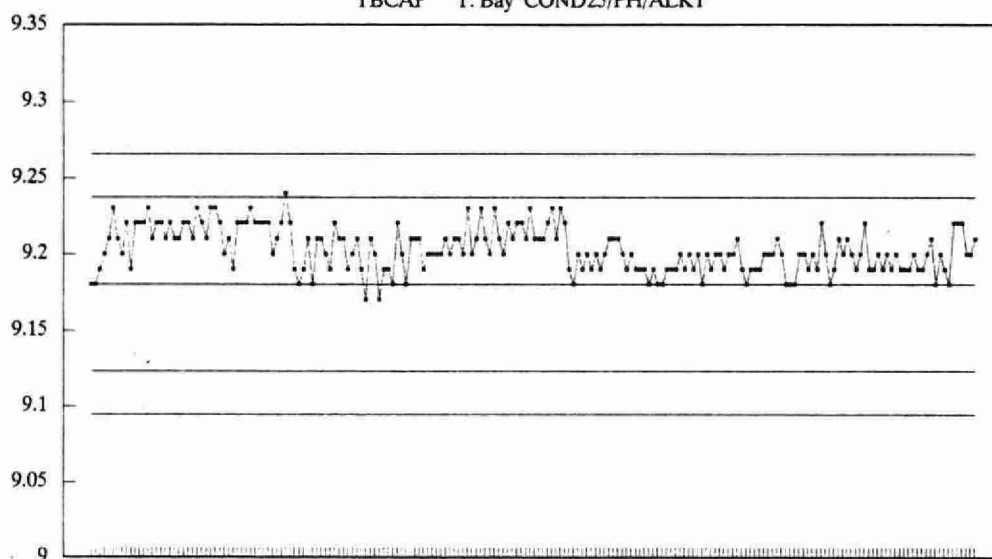
For 1992 Control Charts:

$$Sw (A-B) = 0.0286$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
7	0.00 – 1.80	5.419	0.0657
95	1.80 – 4.50	6.623	0.0446
440	4.50 – 9.00	7.718	0.0539

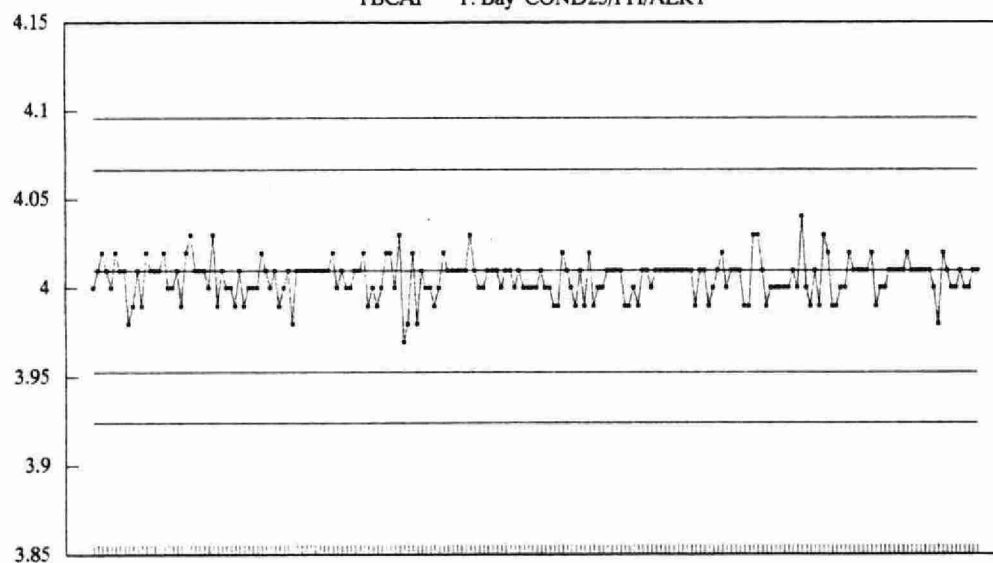
PH PH TBCAP T. Bay COND25/PH/ALKT



Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

— QCA

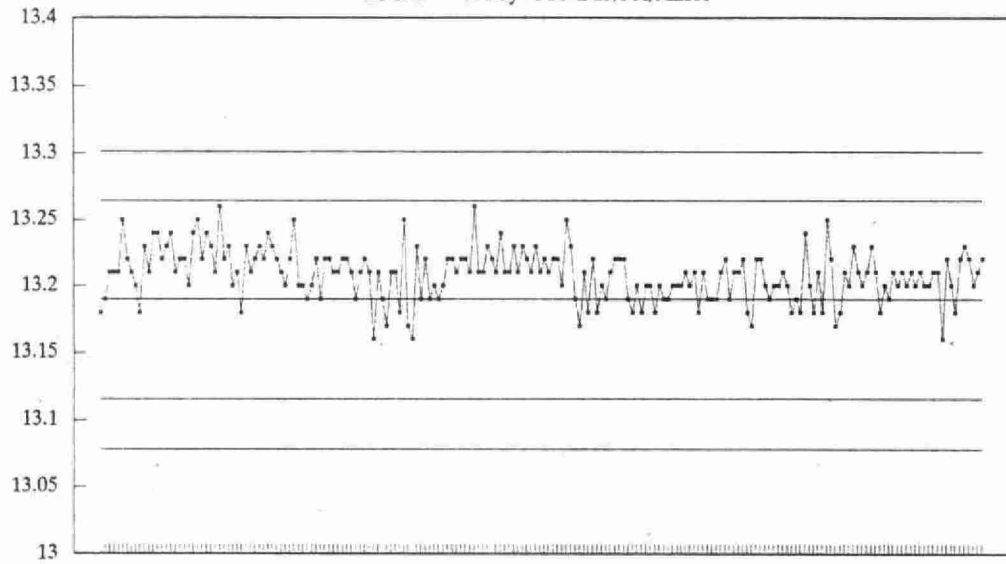
PH PH TBCAP T. Bay COND25/PH/ALKT



Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

— QCB

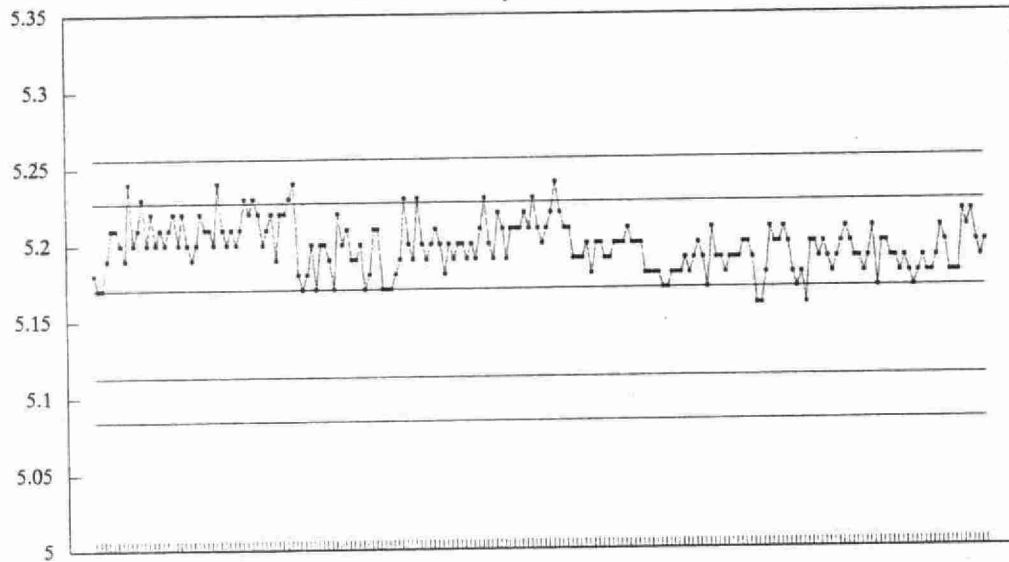
PH PH TBCAP T. Bay COND25/PH/ALKT



— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

PH PH TBCAP T. Bay COND25/PH/ALKT



— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5011 – 7663

***** pH - pH PROBE *****

IDENTIFICATION:

LIS Test Name Code: PHPROB
Work Station Code : TBPH
Method Code : E6009A

Introduced: May, 1977
Units : Dimensionless
Section : Water Quality

SAMPLE TYPE/MATRIX:

Surface waters, drinking water, ground water, sewage effluents, industrial wastes and precipitation samples.

SAMPLING:

Special Instructions:

Container : Glass or PET jars
Preservative : Refrigerate at 4°C

ANALYTICAL PROCEDURE:

pH is measured directly on a stirred sample using a hydrogen ion sensitive glass combination electrode. The meter is calibrated in pH units against buffers of known pH.

INSTRUMENTATION:

Fisher Accumet 925 pH Meter, magnetic stirrer.

CALIBRATION:

- Two point calibration
- Buffers 6.86 and 4.01

CONTROLS AND QUALITY ASSURANCE:

Calibration: QCA, QCB
Drift : Buffers are re-analyzed periodically
Duplicates : DUP (1 every 10 samples)

Reporting: Maximum Significant Figures: 2
W Value: N/A T Value: N/A

MODIFICATIONS:

pH PROBE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 9

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	200	9.18	9.169	-0.011	0.0252
QCB:	200	4.01	4.002	-0.008	0.0105
QCA+QCB:	200	13.19	13.171	-0.019	0.0249
QCA-QCB:	200	5.17	5.167	-0.003	0.0296

For 1992 Control Charts:

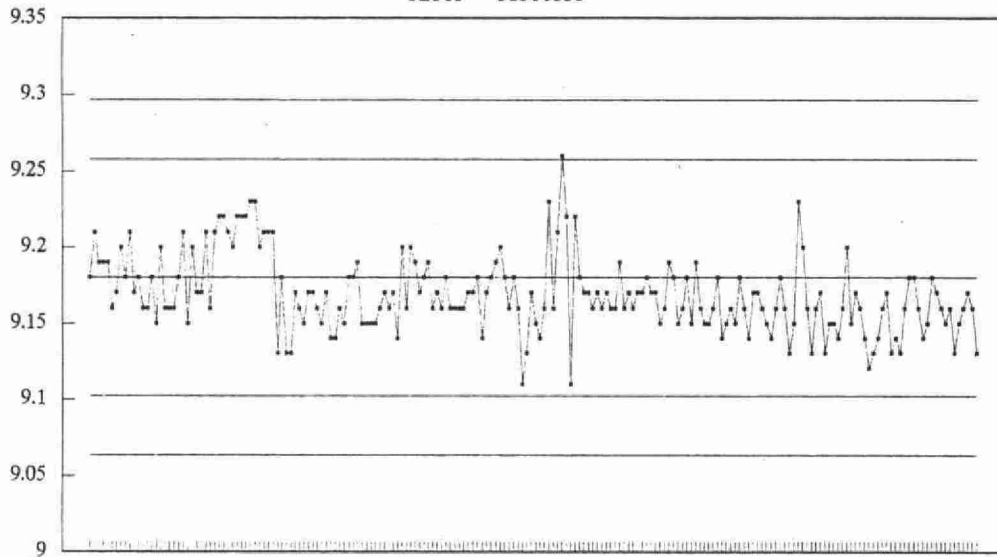
$$Sw (A-B) = 0.0389$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
8	0 – 1.8	5.334	0.0224
102	1.8 – 4.5	6.557	0.0247
217	4.5 – 9.0	7.500	0.0237

PHPROB PH PROBE

TBPH PH Probe

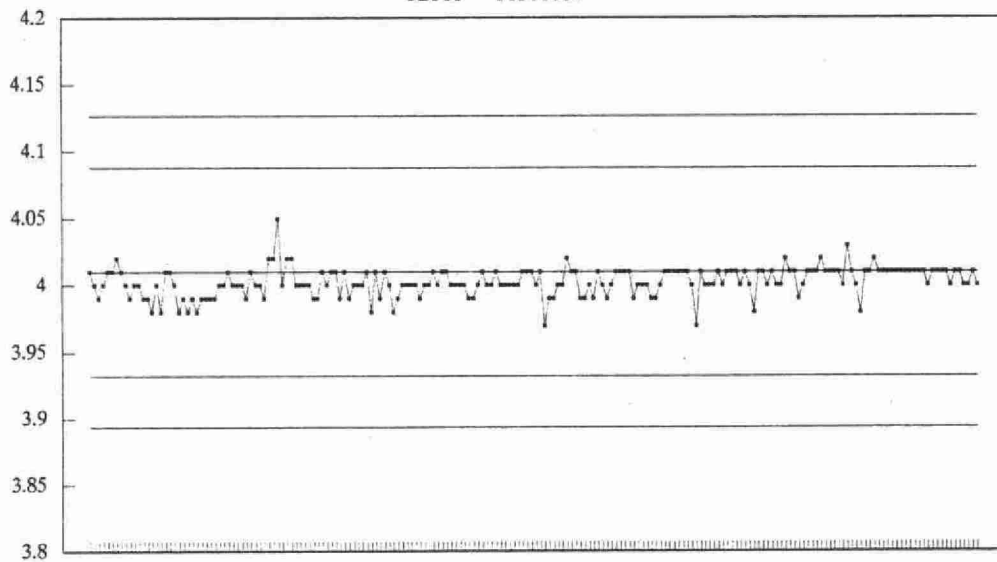


QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

PHPROB PH PROBE

TBPH PH Probe

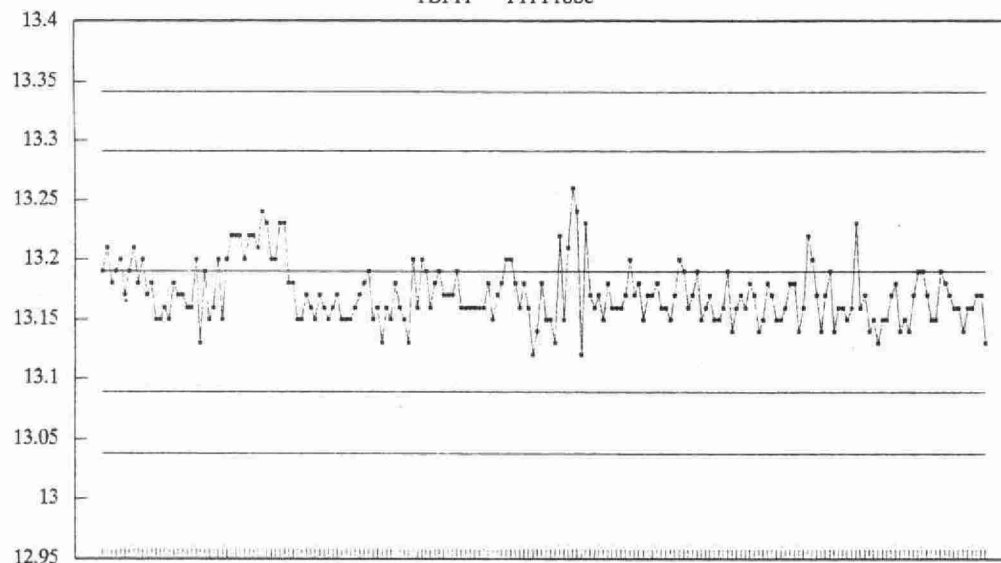


QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

PHPROB PH PROBE

TBPH PH Probe

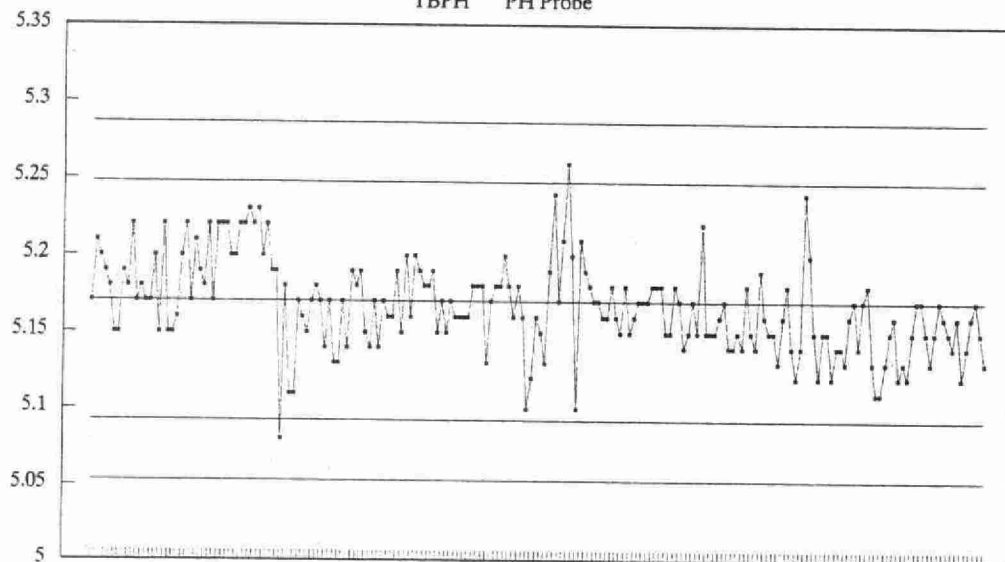


QCA+QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

PHPROB PH PROBE

TBPH PH Probe



QCA-QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5011 - 7663

***** PHOSPHORUS-REACTIVE ORTHOPHOSPHATE *****

IDENTIFICATION:

LIS Test Name Code:	PPO4FR	Introduced	: 1978
Work Station Code :	TBNDNP	Units	: mg/L as P
Method Code	: E6024A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Orthophosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
N.B. Ammonia, nitrate plus nitrite, and nitrite are determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI with 37°C heating bath. Colourimetric measurement is through a 5.0 cm. light path at 630 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 0.10 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift : BLK every 10 samples, CHK (100%) every 20 samples
Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: 0.001 T Value: 0.005

CAEAL Certified and QM Blind Audit participant.

MODIFICATIONS:

1988 - All channels went to microcomputer control with DCI software.

PHOSPHORUS—REACTIVE ORTHOPHOSPHATE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 0.1 mg/L as P

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	74	0.080	0.079	-0.001	0.0015
QCB:	74	0.020	0.019	-0.001	0.0011
QCC:	74	0.008	0.007	-0.001	0.0011
QCA+QCB:	74	0.100	0.098	-0.002	0.0024
QCA-QCB:	74	0.060	0.060	0.000	0.0012
QCB+QCC:	74	0.028	0.026	-0.002	0.0018
QCB-QCC:	74	0.012	0.012	0.000	0.0012

For 1992 Control Charts:

Sw (A-B) = 0.0011

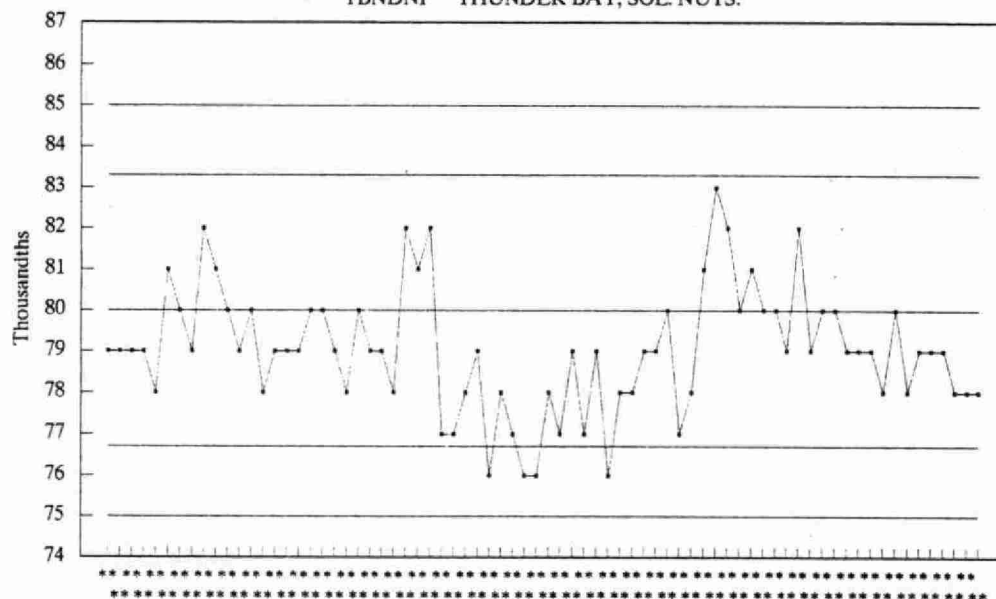
Sw (B-C) = 0.0016

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
153	0.00 – 0.02	0.004	0.0010
29	0.02 – 0.05	0.034	0.0017
13	0.05 – 0.10	0.063	0.0032

PPO4FR Phosphates, Frac.React.

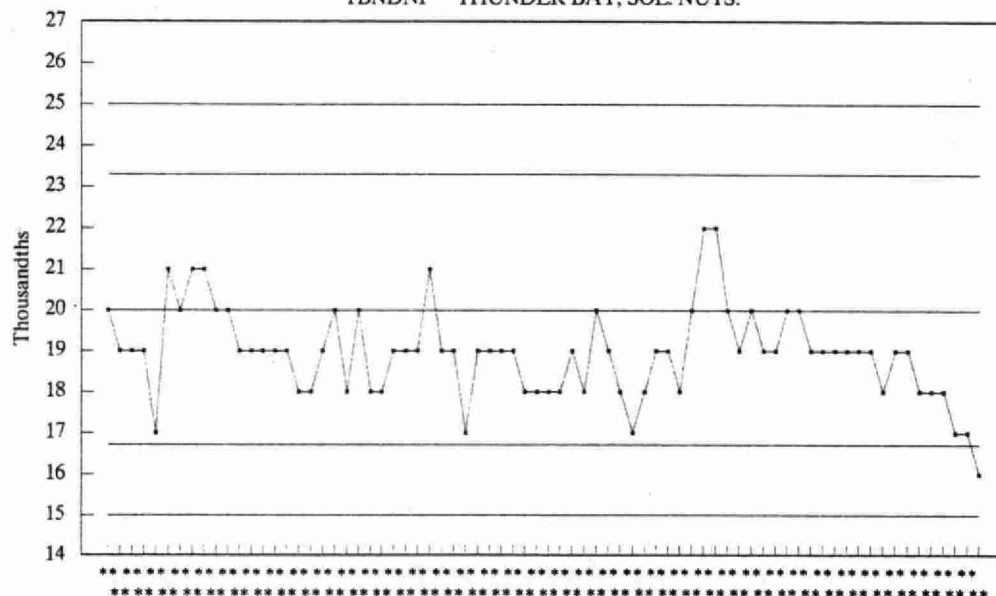
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

PPO4FR Phosphates, Frac.React.

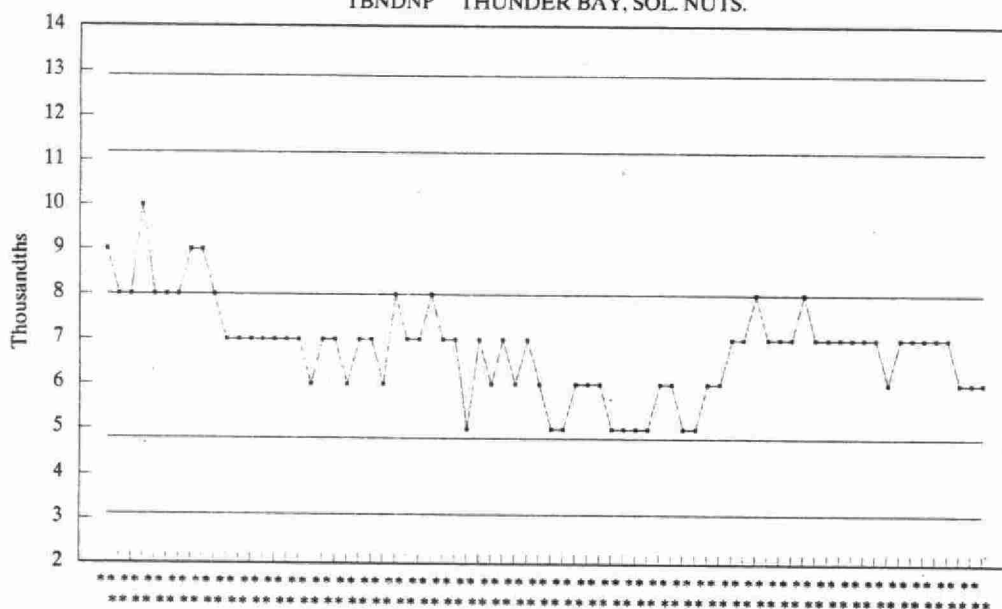
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

PPO4FR Phosphates, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.

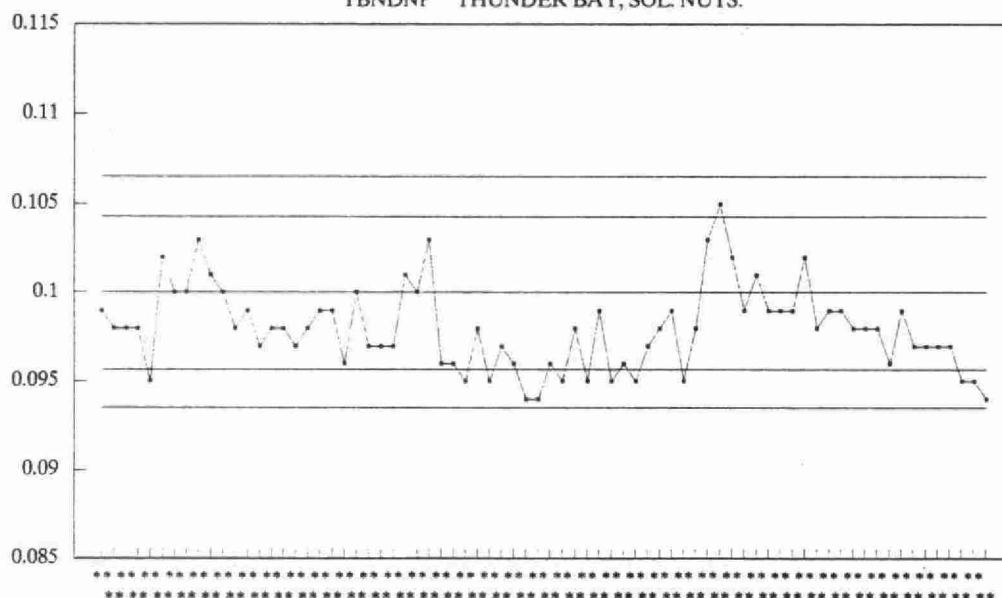


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

— QCC

PPO4FR Phosphates, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.

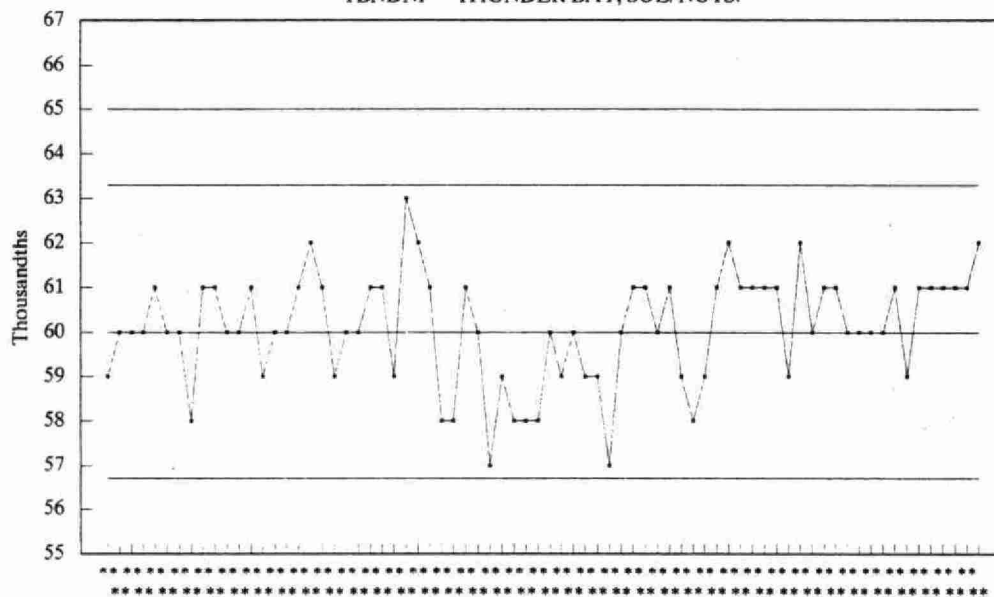


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

— QCA+QCB

PPO4FR Phosphates, Frac.React.

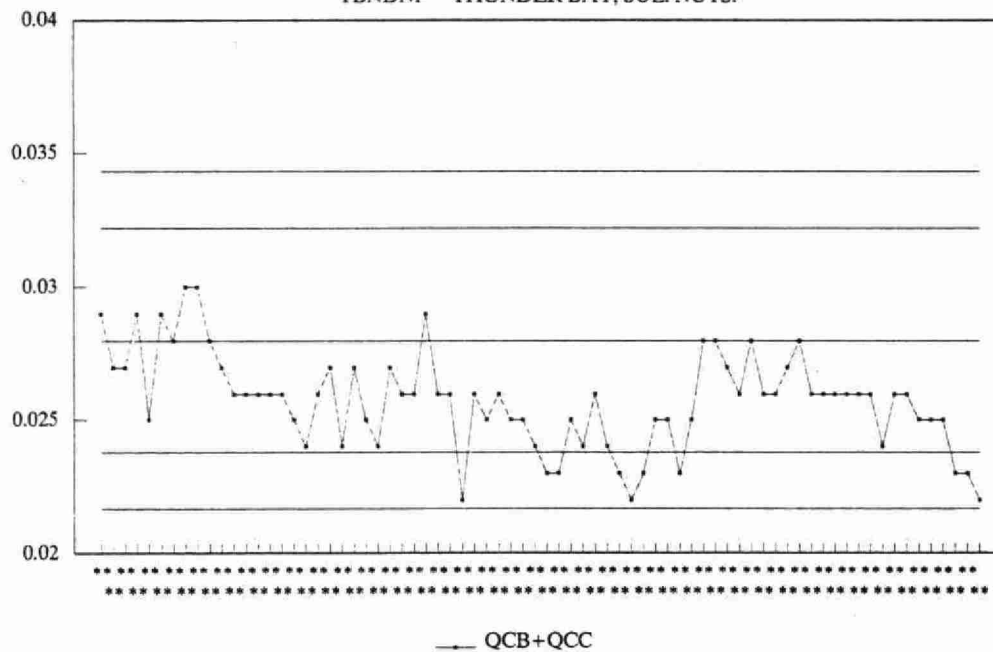
TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

PPO4FR Phosphates, Frac.React.

TBNDNP THUNDER BAY, SOL. NUTS.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5050 - 7648

TBNDNP THUNDER BAY, SOL. NUTS.



Runs: 5050 - 7648

***** SILICON - MOLYBDATE REACTIVE SILICATES *****

IDENTIFICATION:

LIS Test Name Code: SIO3UR	Introduced	: January 1978
Work Station Code : TBSIO3UR	Units	: mg/L as Si
Method Code : E6025A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface waters, domestic waters, leachates and industrial effluents.

SAMPLING:

Special Instructions: Do not use glass containers.
Container : PET or Nalgene
Preservative : Refrigerate at 4°C

ANALYTICAL PROCEDURE:

Reactive silicates are determined by the formation of a reduced molybdo-silicate complex at pH 1.2. Ascorbic acid is the reducing agent. Oxalic acid suppresses phosphate interference.

INSTRUMENTATION:

Technicon Auto-Analyzer II continuous flow system with colourimetric measurement through a 50 mm light path at 660 nm.

CALIBRATION:

- Linear
- 8 Standards, 0 - 3.0 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB
Drift : BLK (every 10 samples); SENS.CHK (2 every 20 samples)
Duplicates : DUP (every 10 samples)

Reporting : Maximum Significant Figures: 2
W Value: .02 T Value: .10

CAEAL Certified, LRTAP and QM Blind Audit participant

MODIFICATIONS:

January 1990 - The reporting procedure was changed to include the range 0.02 mg/L to 0.1 mg/L.

SILICON – MOLYBDATE REACTIVE SILICATES

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 3 mg/L as Si

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	19	1.4	1.3605	-0.039	0.0151
QCB:	19	0.2	0.1916	-0.008	0.0083
QCA + QCB:	19	1.6	1.5521	-0.048	0.0196
QCA - QCB:	19	1.2	1.1689	-0.031	0.0145

For 1992 Control Charts:

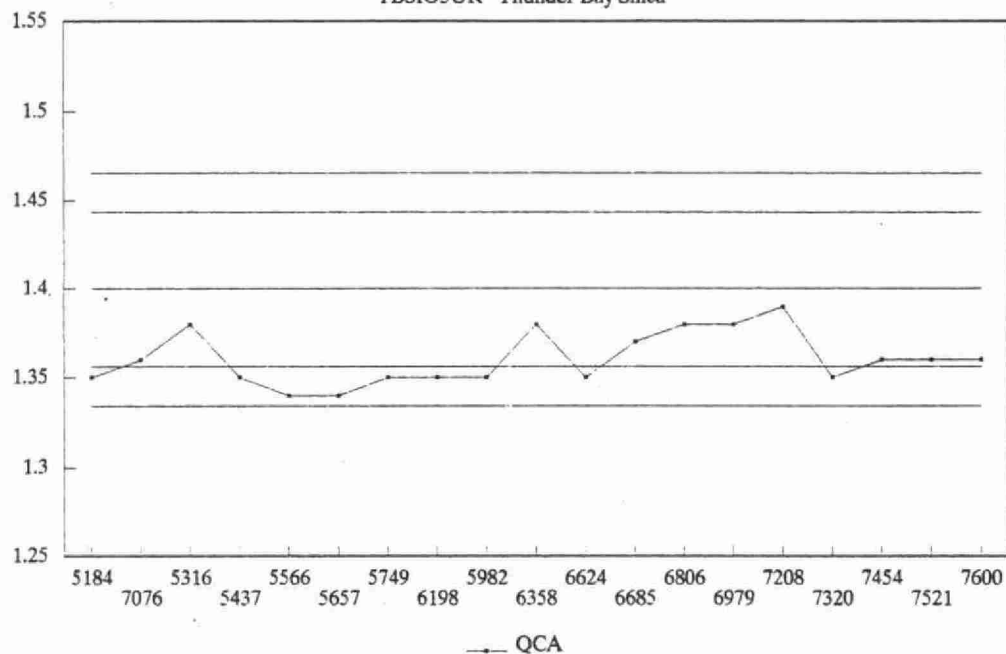
$$Sw (A-B) = 0.0219$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
9	0 - 0.6	0.304	0.0103
26	0.6 - 1.5	1.170	0.0161
10	1.5 - 3.0	2.197	0.0251

SIO3UR Silicates, Inf, Reactive

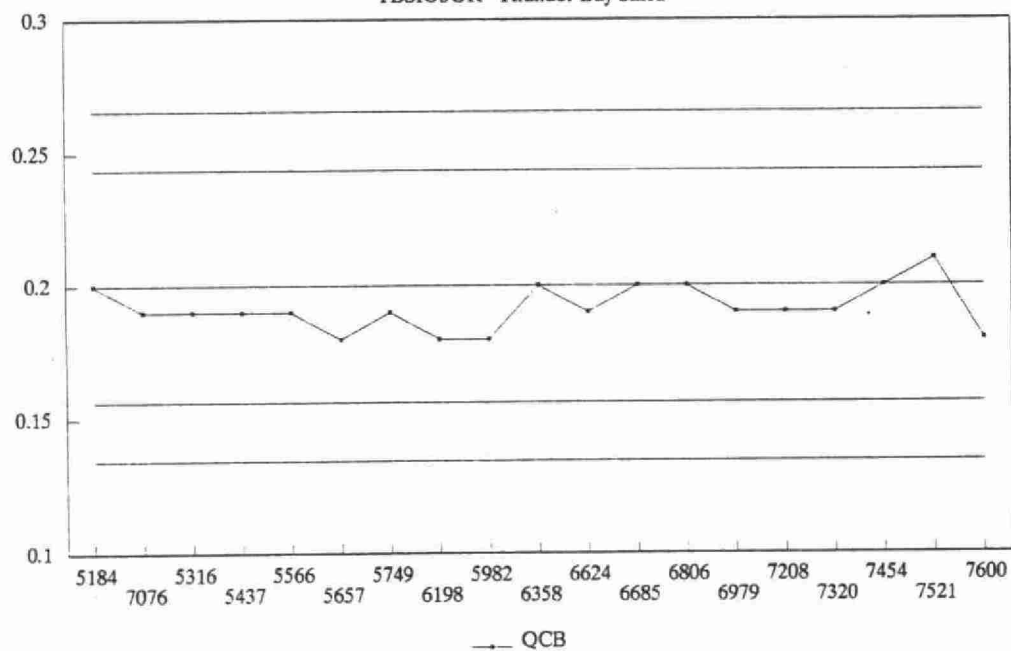
TBSIO3UR Thunder Bay Silica



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5184 - 7600

SIO3UR Silicates, Inf, Reactive

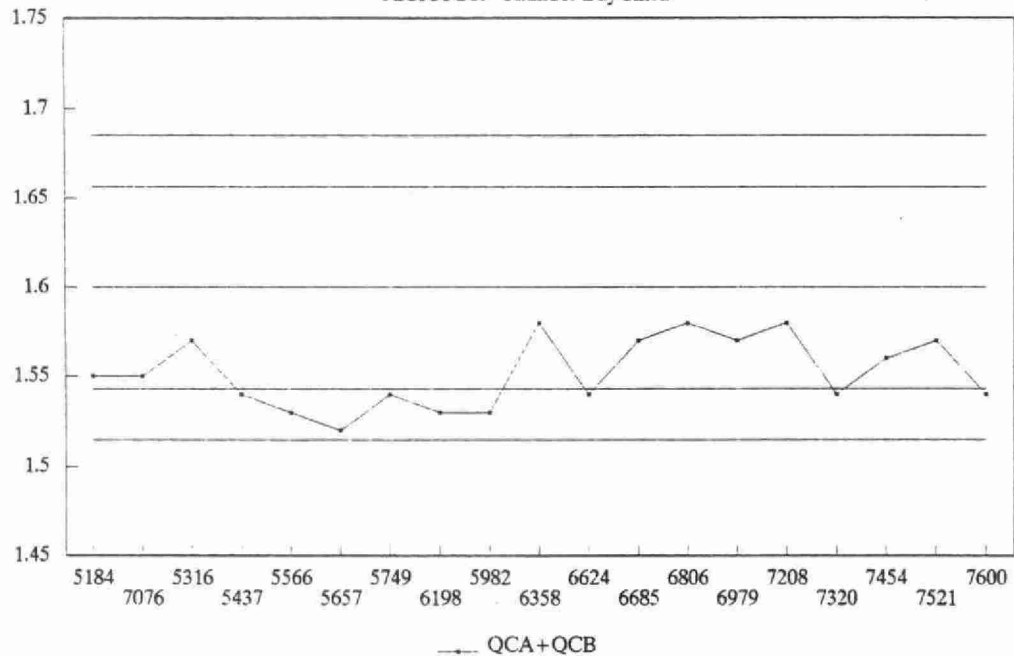
TBSIO3UR Thunder Bay Silica



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5184 - 7600

SIO3UR Silicates, Inf, Reactive

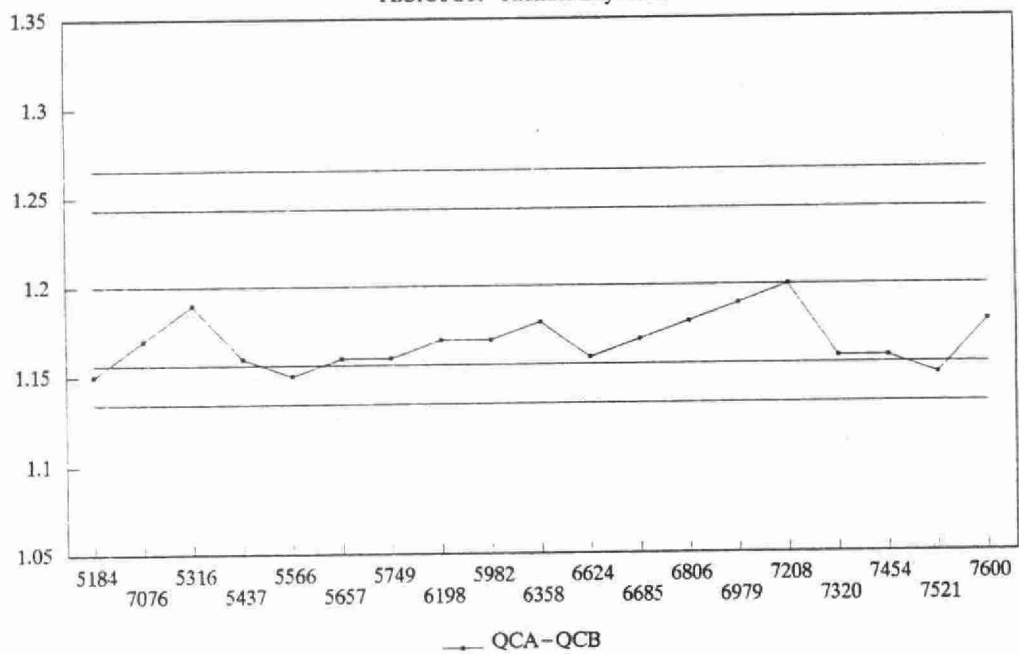
TBSIO3UR Thunder Bay Silica



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5184 - 7600

SIO3UR Silicates, Inf, Reactive

TBSIO3UR Thunder Bay Silica



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5184 - 7600

***** SOLIDS - DISSOLVED *****

IDENTIFICATION:

LIS Test Name Code: RSF	Introduced	: 1980
Work Station Code : TBSOLIDS	Units	: mg/L
Method Code : E6030A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewages, surface waters, precipitation, industrial effluents and landfill leachates.

SAMPLING:

Special Instructions:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

A volume of sample is vacuum filtered through a pre-washed glass fibre filter; a 50 mL aliquot of filtrate is evaporated in a pre-weighed ceramic dish overnight at $103^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The increase in weight over that of the empty dish represents the dissolved solids. Data collection, calculations and transfer of results are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 place), drying oven, micro-computer system with appropriate software.

CALIBRATION:

- Balance internal calibration, tare

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 S class weights
Drift : Balance zero
Duplicates : DUP (1 for every 10 samples)

Reporting:	Maximum Significant Figures: 2
	W Value: 5.0 T Value: 25.0

MODIFICATIONS:

September, 1984 - Commodore computer set up for input.
September, 1988 - Direct Computer Input with Commodore computer.
June, 1989 - Microcomputer and in-house Lotus program replaces Commodore computer.

SOLIDS – DISSOLVED**Quality Control Data from January 1 to December 31, 1992**

Analytical Range – to 4000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
17	0 – 800	206.235	3.0486
2	800 – 2000	1464.500	14.8661
1	2000 – 4000	3444.000	2.1213

***** SOLIDS - PARTICULATE *****

IDENTIFICATION:

LIS Test Name Code: RSP	Introduced	: 1980
Work Station Code : TBSOLIDS	Units	: mg/L
Method Code : E6035A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewages, surface waters, industrial effluents and landfill leachates.

SAMPLING:

Special Instructions:

Container : PET or glass
Preservative : Refrigerate at 4°C

ANALYTICAL PROCEDURE:

An aliquot of sample (50-500 mL) is vacuum filtered through a pre-weighed Whatman 934 AH glass fibre filter paper. The residue is dried at 103°C $\pm$ 2°C and the particulate solids are determined gravimetrically. Data collection, calculations and transfer of results are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 place), drying oven, vacuum filtration apparatus, micro-computer system with appropriate software.

CALIBRATION:

- Balance internal calibration, tare

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 S class weights
Recovery : LTB, REC1, REC2
Drift : Balance zero
Duplicates : DUP (1 for every 10 samples)

Reporting: Maximum Significant Figures: 2
W Value: 1.0 T Value: 5.0

CAEAL Certified

MODIFICATIONS:

September, 1984 - Commodore computer set up for input.
September, 1988 - Direct Computer Input with Commodore computer.
June, 1989 - In-house Lotus program replaces Commodore.

SOLIDS – PARTICULATE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 200mg/L

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	133	0.50	0.500	-0.000010	0.000020
QCB:	133	0.05	0.050	0.000001	0.000021
QCA+QCB:	133	0.55	0.550	-0.000008	0.000033
QCA-QCB:	133	0.45	0.450	-0.000011	0.000025

For 1992 Control Charts:

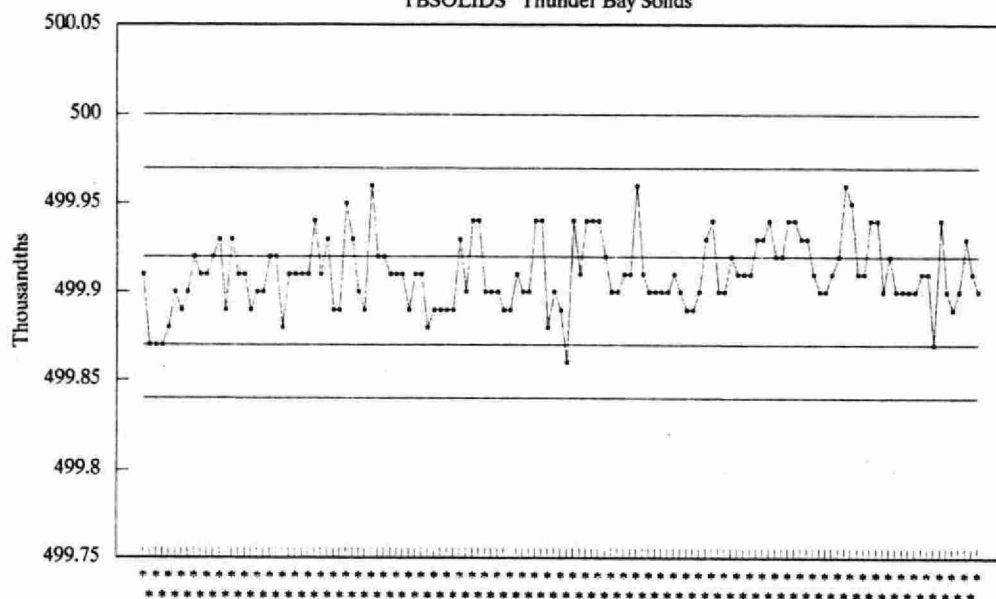
$$Sw (A-B) = 0.0000266$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
495	0 – 40	9.277	0.7528
116	40 – 100	68.586	2.1735
75	100 – 200	136.107	3.9379

RSP Residue, Particulate

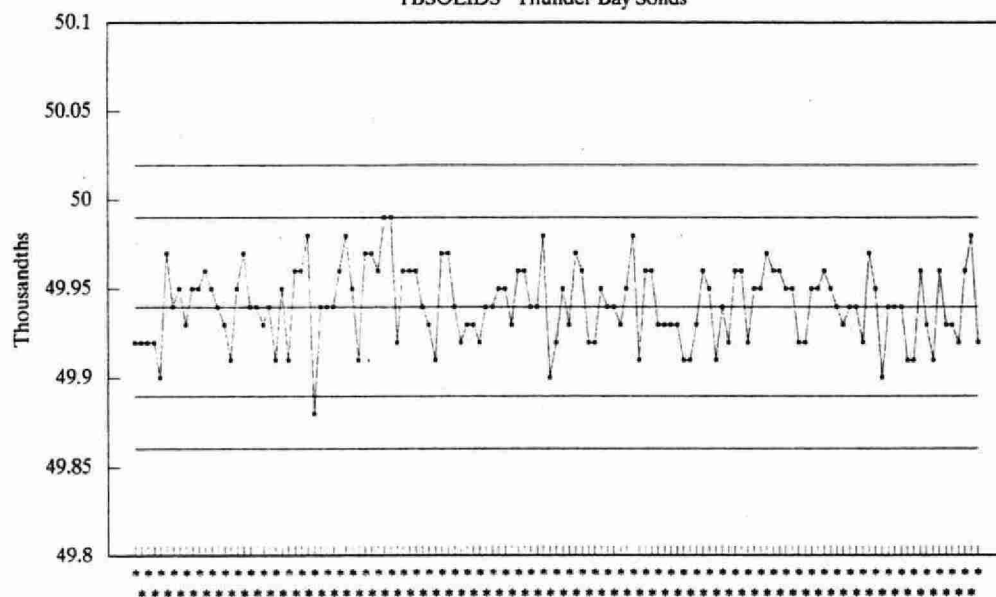
TBSOLIDS Thunder Bay Solids



Jan. 01, 1992 – Dec. 31, 1992
Runs: 4974 – 7614

RSP Residue, Particulate

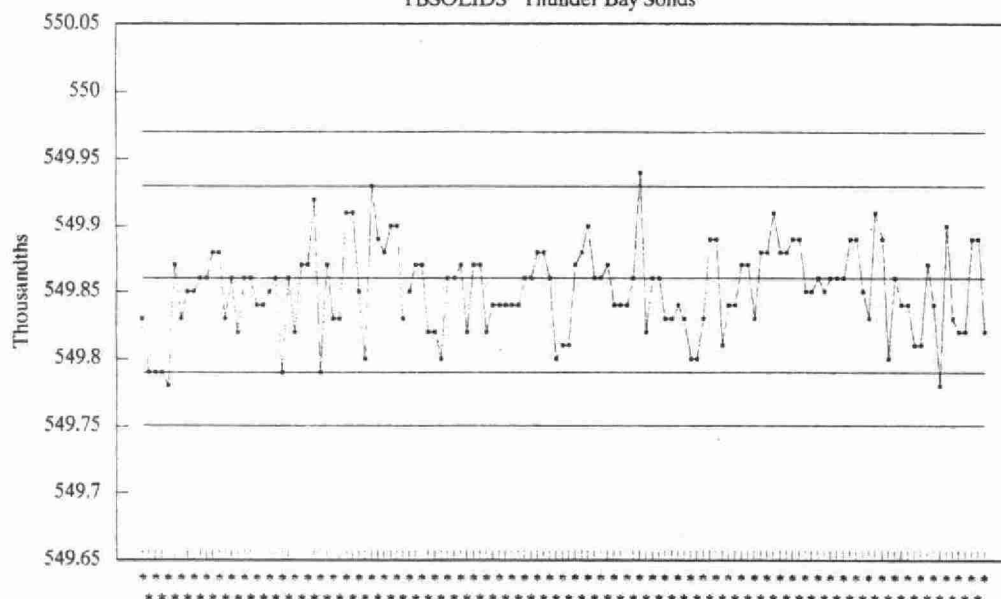
TBSOLIDS Thunder Bay Solids



Jan. 01, 1992 – Dec. 31, 1992
Runs: 4974 – 7614

RSP Residue, Particulate

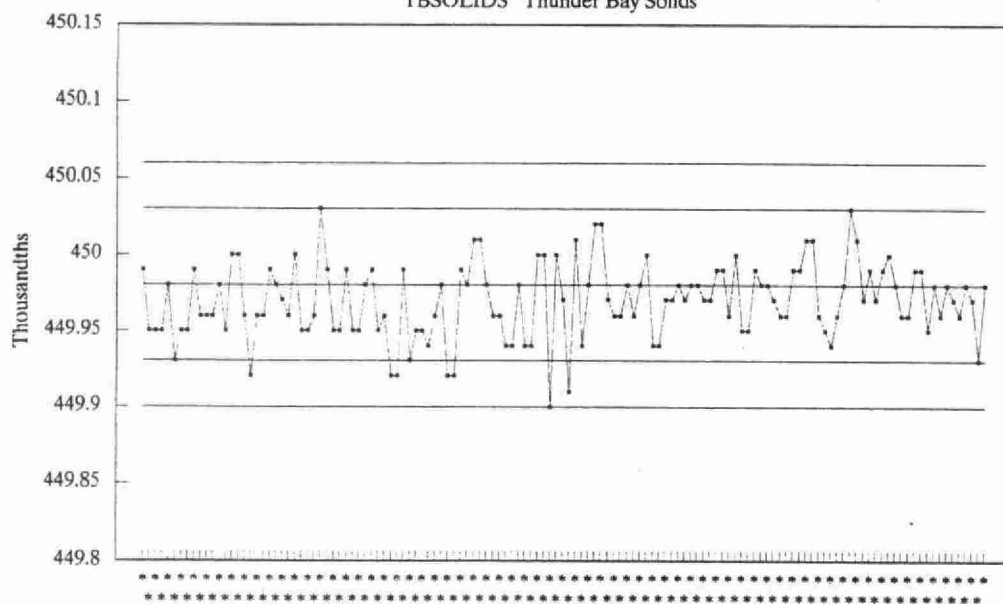
TBSOLIDS Thunder Bay Solids



Jan. 01, 1992 – Dec. 31, 1992
Runs: 4974 – 7614

RSP Residue, Particulate

TBSOLIDS Thunder Bay Solids



Jan. 01, 1992 – Dec. 31, 1992
Runs: 4974 – 7614

***** SOLIDS - TOTAL *****

IDENTIFICATION:

LIS Test Name Code: RST	Introduced	: 1980
Work Station Code : TBSOLIDS	Units	: mg/L
Method Code : E6035A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewages, surface waters, precipitation, industrial effluents and landfill leachates.

SAMPLING:

Special Instructions:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

A well mixed sample is evaporated in a pre-weighed dish and dried to a constant weight in an oven set at 103°C $\pm$ 2°C. The increase in weight over that of the empty dish represents the total solids. Data collection, calculations and transfer of results are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 place), drying oven, micro-computer system with appropriate software.

CALIBRATION:

- Balance internal calibration, tare

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 S class weights
Recovery : LTB, REC1 (2 sets), REC2 (2 sets)
Drift : Balance zero, daily blank, empty dishes (C1, C2)
Duplicates : DUP (1 for every 10 samples)

Reporting:	Maximum Significant Figures: 2
	W Value: 5.0 T Value: 25.0

MODIFICATIONS:

September, 1984 - Commodore computer set up for input.
September, 1988 - Direct Computer Input with Commodore computer.
June, 1989 - In-house Lotus program replaces Commodore.

SOLIDS TOTAL

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 2000 mg/L

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	89	50.00007	50.00004	-0.00003	0.000033
QCB:	89	30.00000	29.99998	-0.00002	0.000026
QCA+QCB:	89	80.00007	80.00003	-0.00004	0.000046
QCA-QCB:	89	20.00007	20.00006	-0.00001	0.000036

For 1992 Control Charts:

$$Sw (A-B) = 0.0000266$$

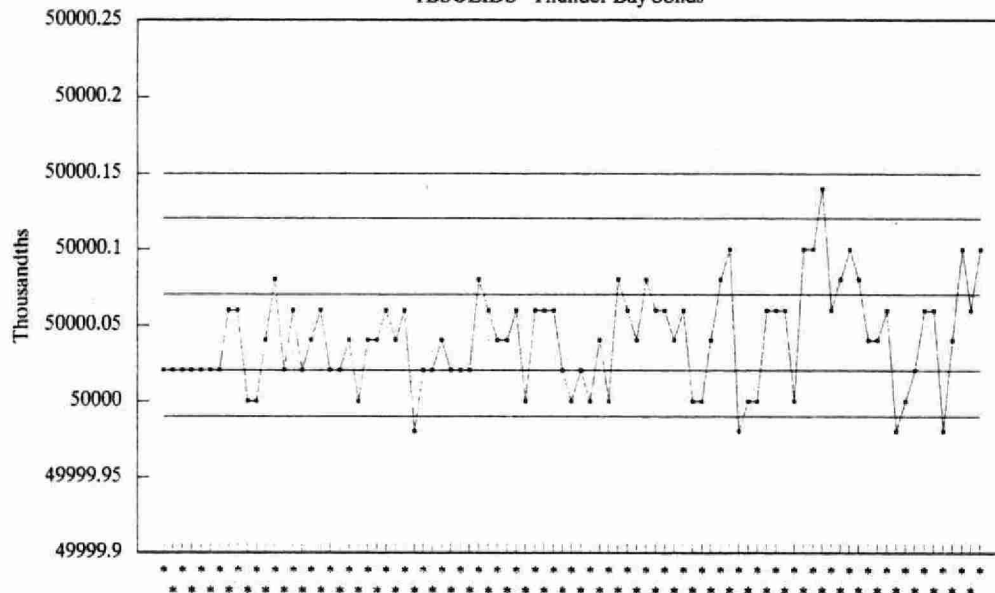
Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
141	0 – 200	88.0284	3.81393
36	200 – 500	304.8611	6.91516
29	500 – 1000	749.5517	11.85181

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
168	0 – 400	116.0595	4.28001
38	400 – 1000	676.5263	10.93100
19	1000 – 2000	1458.7360	12.64286

RST Residue, Total

TBSOLIDS Thunder Bay Solids

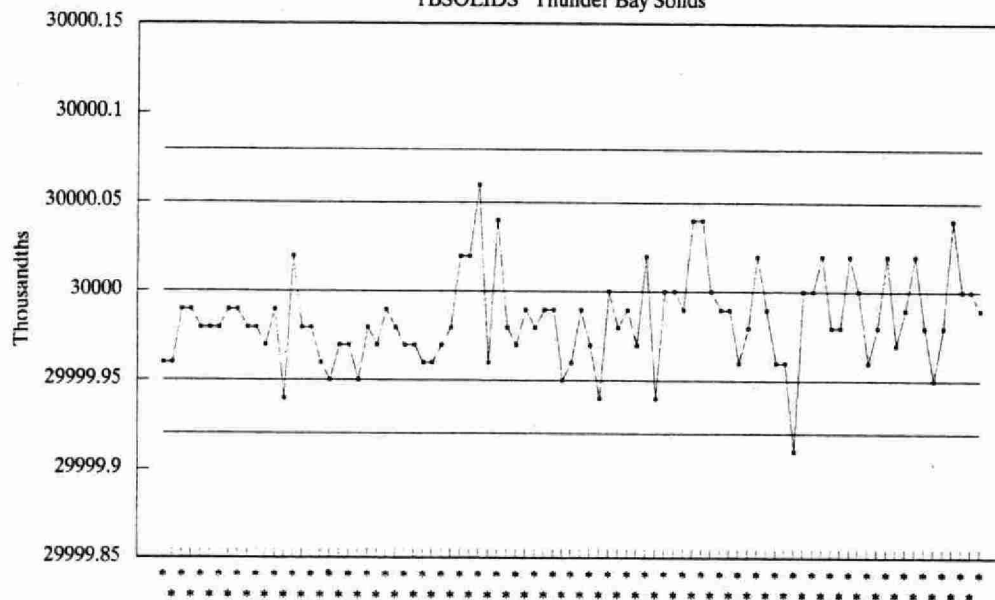


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 4968 – 7614

RST Residue, Total

TBSOLIDS Thunder Bay Solids

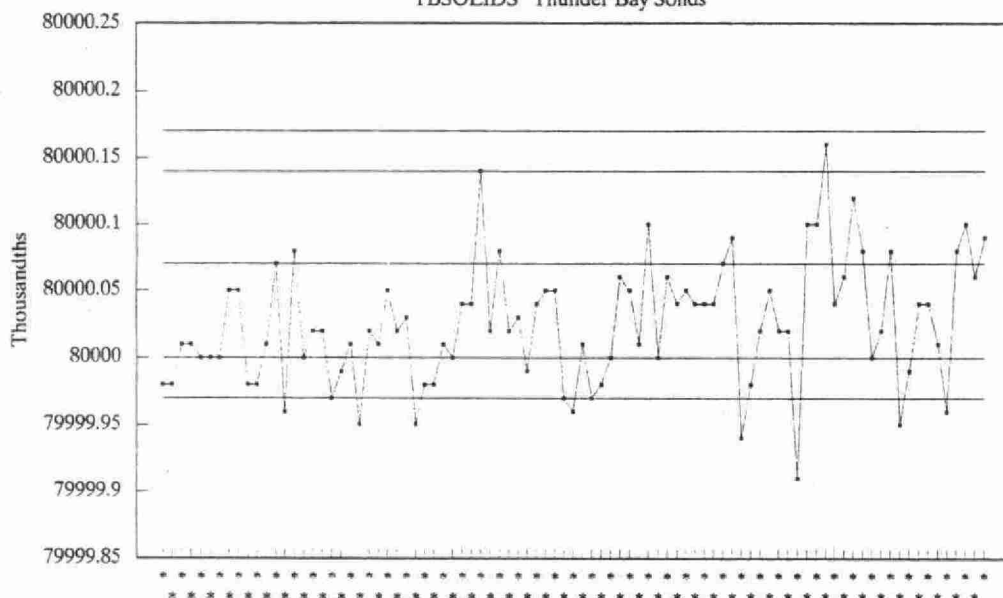


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 4968 – 7614

RST Residue, Total

TBSOLIDS Thunder Bay Solids

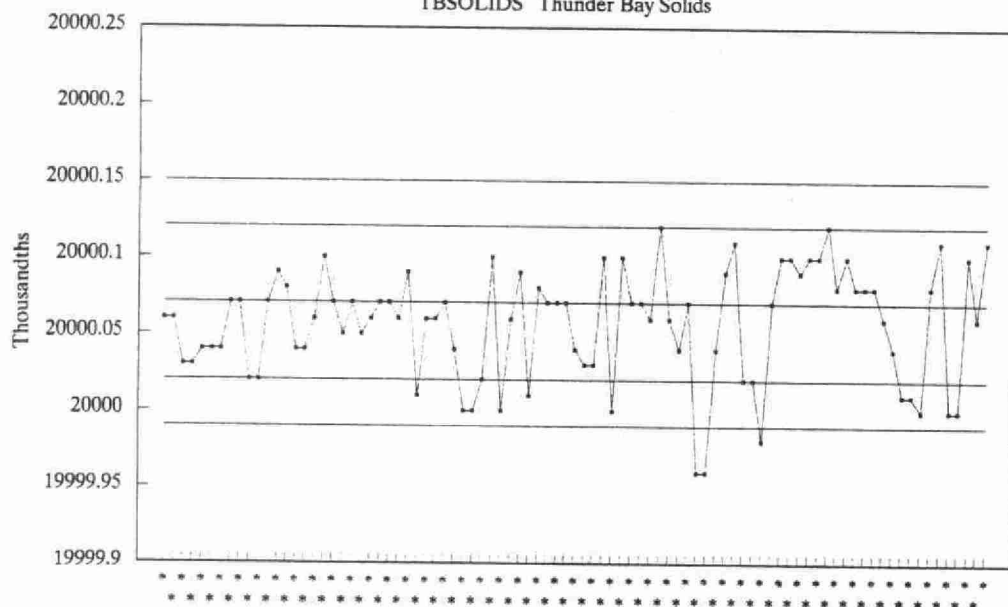


— QCA+QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4968 - 7614

RST Residue, Total

TBSOLIDS Thunder Bay Solids



— QCA-QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4968 - 7614

***** SULPHATE *****

IDENTIFICATION:

LIS Test Name Code:	SSO4UR	Introduced	: 1978
Work Station Code :	TBSSO4UR	Units	: mg/L as SO ₄
Method Code	: E6032B	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, precipitation, snow, industrial effluent and landfill leachate.

SAMPLING:

Special Instructions:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

Using a sodium bicarbonate/sodium carbonate eluent, sulphate is separated with automated ion suppression chromatography utilizing a conductivity detector, for a response vs. time chromatogram.

INSTRUMENTATION:

Dionex 2000i/SP Suppressed Ion Chromatography Module with auto-sampler, computer and controlling software.

CALIBRATION:

- Quadratic
- 6 Standards, 2-50 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC
Drift : SENS.CHK (2 every 20 samples)
Duplicates : 3 DUPS (analyzed at beginning of run)

Reporting:	Maximum Significant Figures: 3
	W Value: 0.5 T Value: 2.5

CAEAL Certified, LRTAP and QM Blind Audit participants

MODIFICATIONS:

1978-1984 -Sulphate analyzed using BaCl₂-methylthymol blue colourimetric method.
1984-1990 -Sulphate analyzed using Wescan Ion Chromatography module.
Aug. 1990 -Chromatography Module changed to Dionex 2000i/SP.
May 1991 -Dionex Autosampler was added to replace Technicon Sampler IV.

SULPHATE

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 50 mg/L as SO₄

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	84	45	45.317	0.317	0.4241
QCB:	84	15	15.134	0.134	0.3578
QCC:	84	5	4.915	-0.085	0.2047
QCA + QCB:	84	60	60.451	0.451	0.7148
QCA - QCB:	84	30	30.183	0.183	0.3237
QCB + QCC:	84	20	20.049	0.049	0.5197
QCB - QCC:	84	10	10.219	0.219	0.2639

For 1992 Control Charts:

$$Sw (A-B) = 0.4312$$

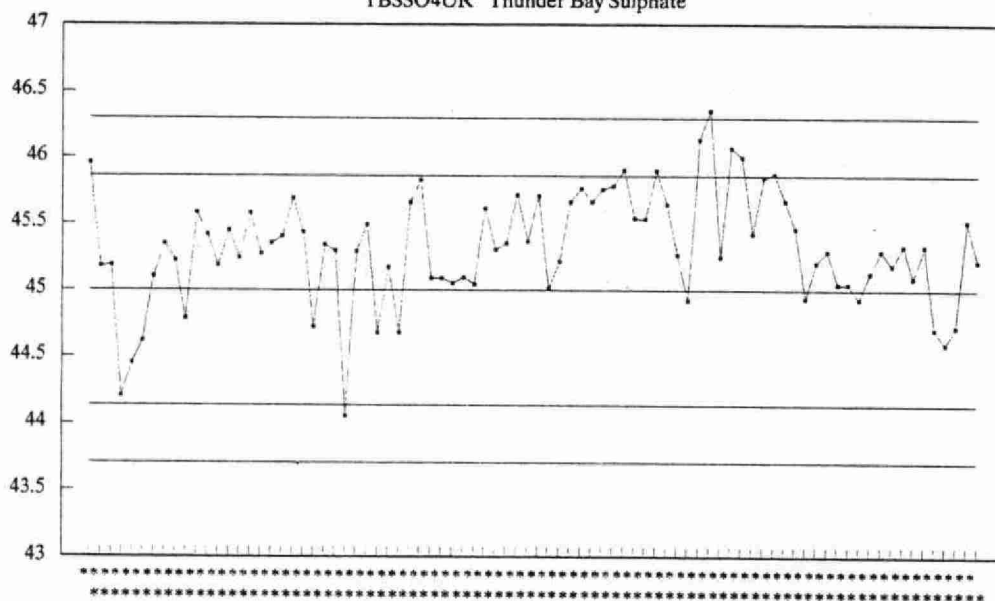
$$Sw (B-C) = 0.2358$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
100	0 - 10	4.862	0.1076
67	10 - 25	16.619	0.1963
31	25 - 50	33.367	0.2603

SSO4UR Sulphate, Unf. Reactive

TBSSO4UR Thunder Bay Sulphate

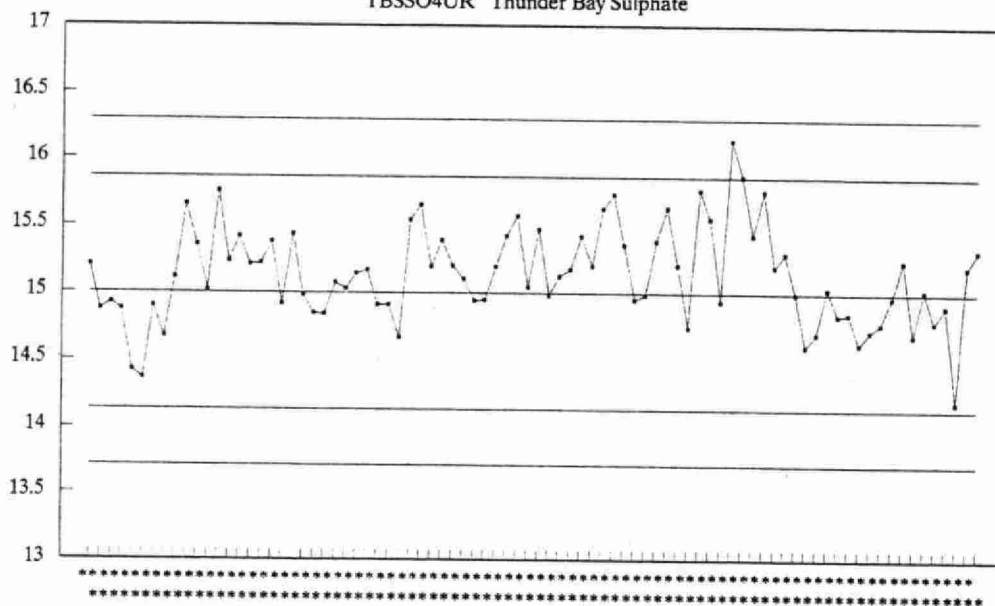


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 7086 – 7658

SSO4UR Sulphate, Unf. Reactive

TBSSO4UR Thunder Bay Sulphate

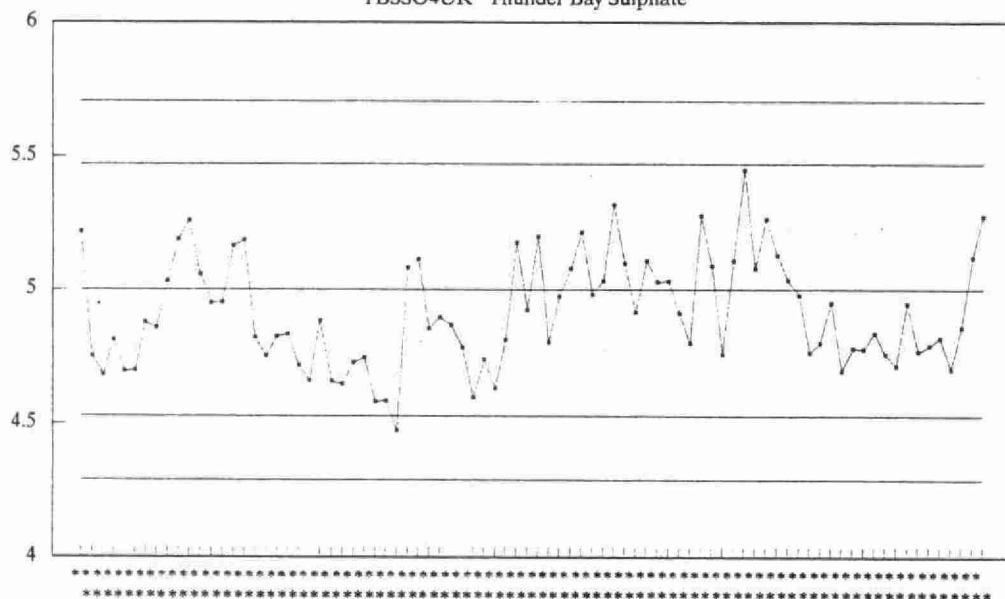


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 7086 – 7658

SSO4UR Sulphate, Unf. Reactive

TBSSO4UR Thunder Bay Sulphate

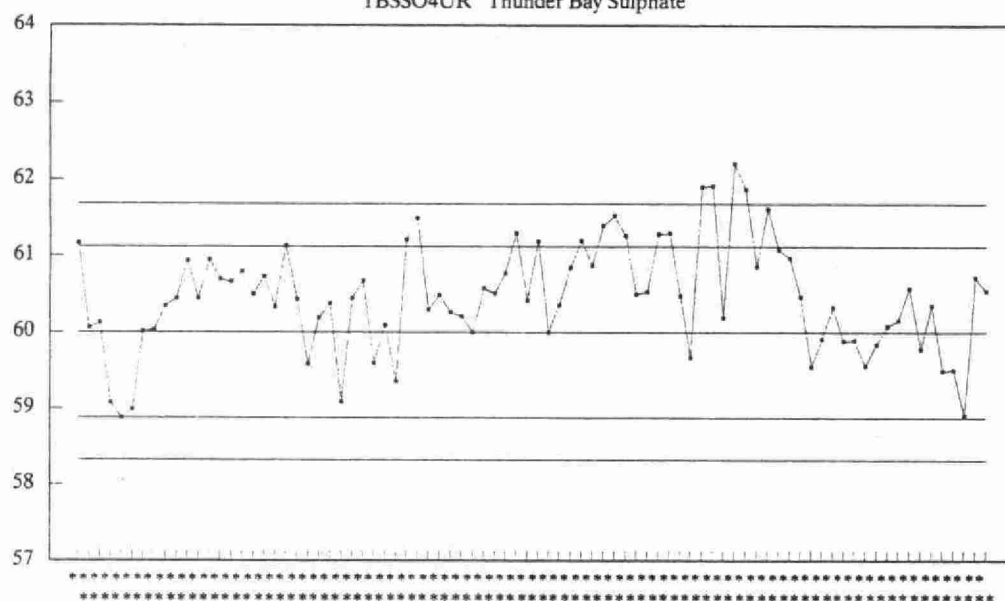


— QCC

Jan. 01, 1992 – Dec. 31, 1992
Runs: 7086 – 7658

SSO4UR Sulphate, Unf. Reactive

TBSSO4UR Thunder Bay Sulphate

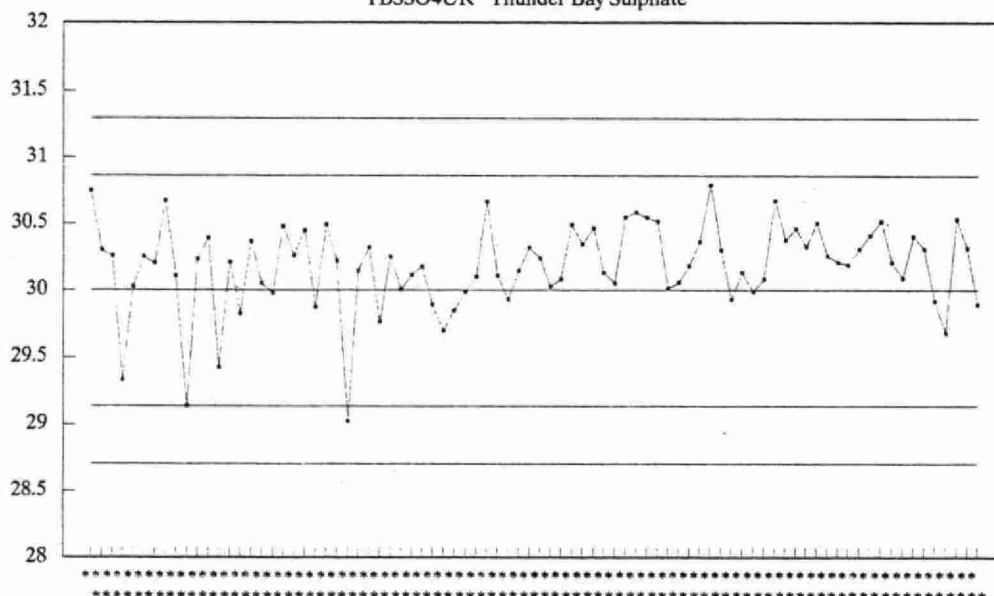


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 7086 – 7658

SSO4UR Sulphate, Unf. Reactive

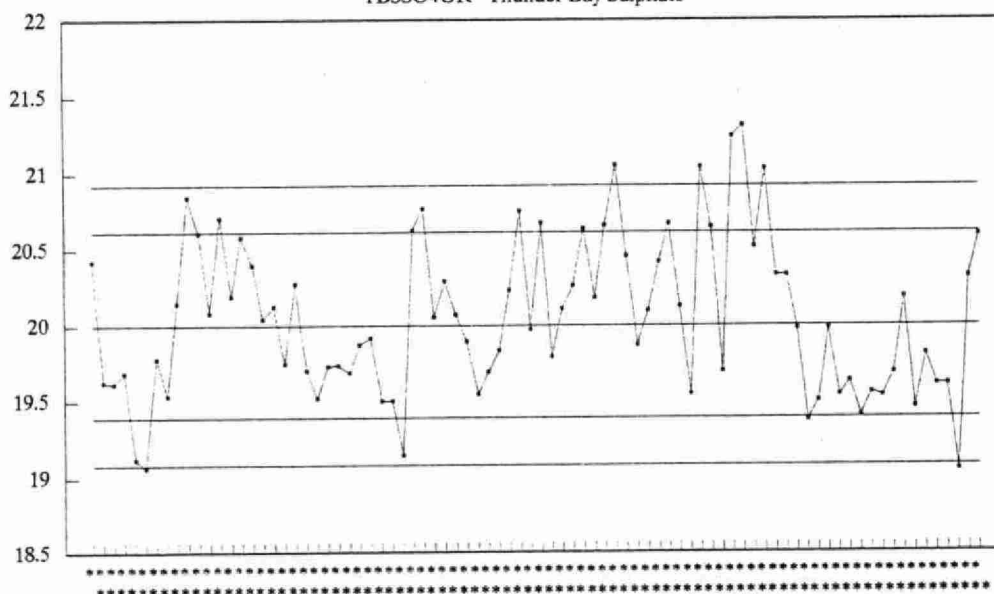
TBSSO4UR Thunder Bay Sulphate



Jan. 01, 1992 - Dec. 31, 1992
Runs: 7086 - 7658

SSO4UR Sulphate, Unf. Reactive

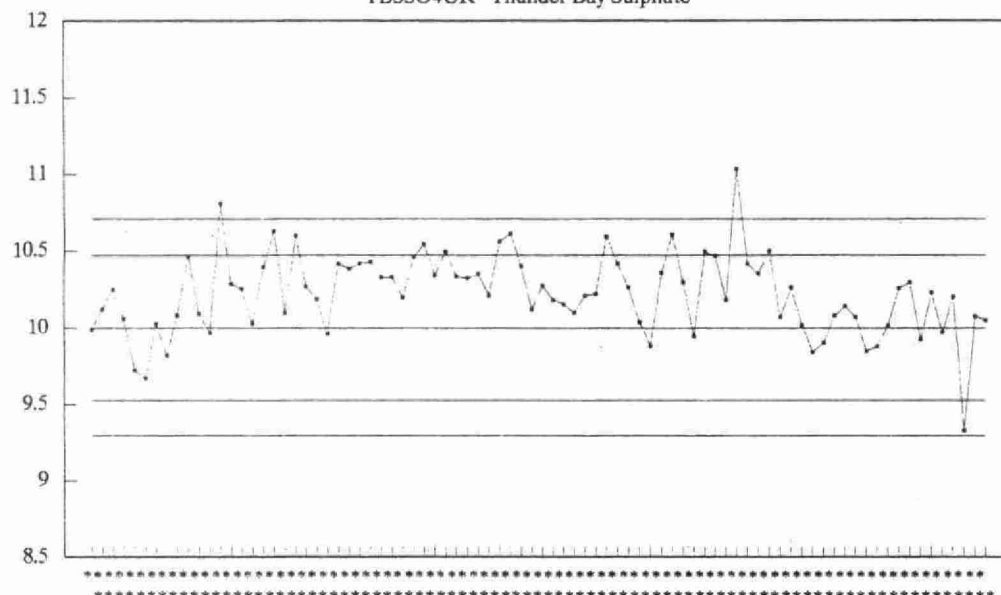
TBSSO4UR Thunder Bay Sulphate



Jan. 01, 1992 - Dec. 31, 1992
Runs: 7086 - 7658

SSO4UR Sulphate, Unf. Reactive

TBSSO4UR Thunder Bay Sulphate



Jan. 01, 1992 - Dec. 31, 1992
Runs: 7086 - 7658

— QCB-QCC

***** TOTAL KJELDAHL NITROGEN *****

IDENTIFICATION:

LIS Test Name Code: NNTKUR	Introduced	: 1978
Work Station Code : TBTNTP	Units	: mg/L as N
Method Code : E6026A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters set at 200°C and 360°C. The digested sample is then neutralized and analyzed for ammonia species using phenate-hypochlorite colourimetry which determines both organic and ammonia forms of nitrogen.
N.B. Total Phosphorus is determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI with a 37°C heating bath. Colourimetric measurement is through a 5.0 cm. light path at 630 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 1.60 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB,
Drift : BLK every 10 samples, CHK (100%) every 20 samples
Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 2
W Value: 0.01 T Value: 0.05

CAEAL Certified, LRTAP and QM Blind Audit participant

MODIFICATIONS:

February 1989 - Both channels went to microcomputer control with DCI software.

TOTAL KJELDAHL NITROGEN

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 1.6 mg/L as N

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	79	1.5	1.506	0.006	0.0170
QCB:	79	0.5	0.507	0.007	0.0135
QCA+QCB:	79	2.0	2.013	0.013	0.0281
QCA-QCB:	79	1.0	0.999	-0.001	0.0125

For 1992 Control Charts:

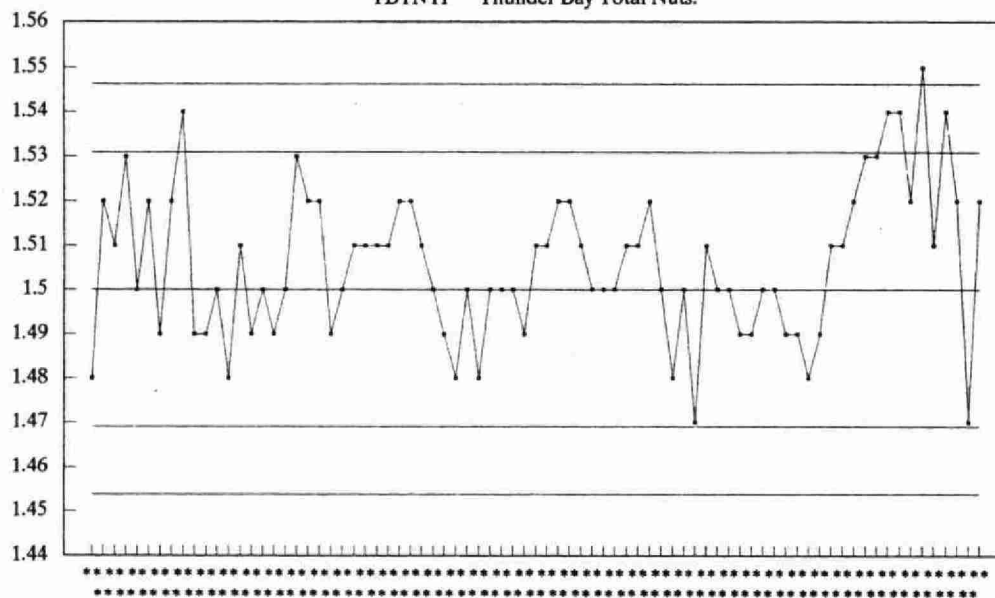
$$Sw (A-B) = 0.0154$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
112	0.00 – 0.32	0.176	0.0129
71	0.32 – 0.80	0.514	0.0272
15	0.80 – 1.60	1.068	0.0307

NNTKUR Nitr'n, Total Kjeld, Unf

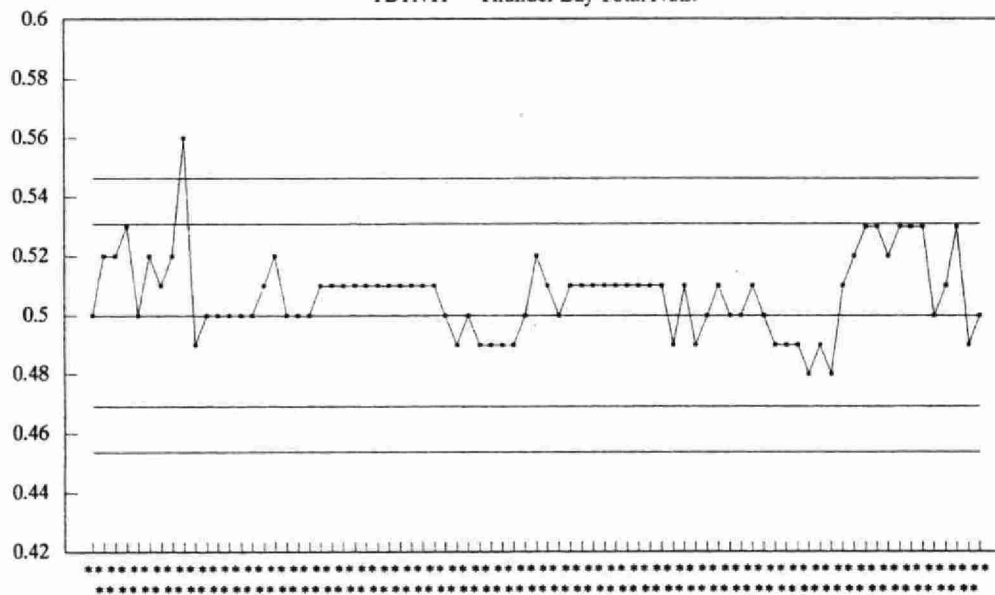
TBTNTP Thunder Bay Total Nuts.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

NNTKUR Nitr'n, Total Kjeld, Unf

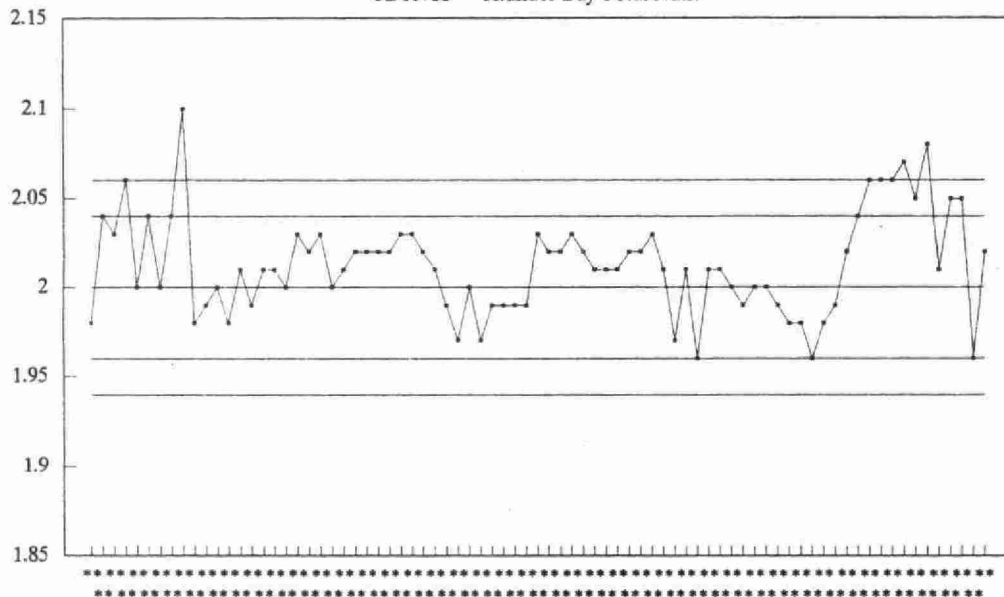
TBTNTP Thunder Bay Total Nuts.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

NNTKUR Nitr'n, Total Kjeld, Unf

TBTNTP Thunder Bay Total Nuts.

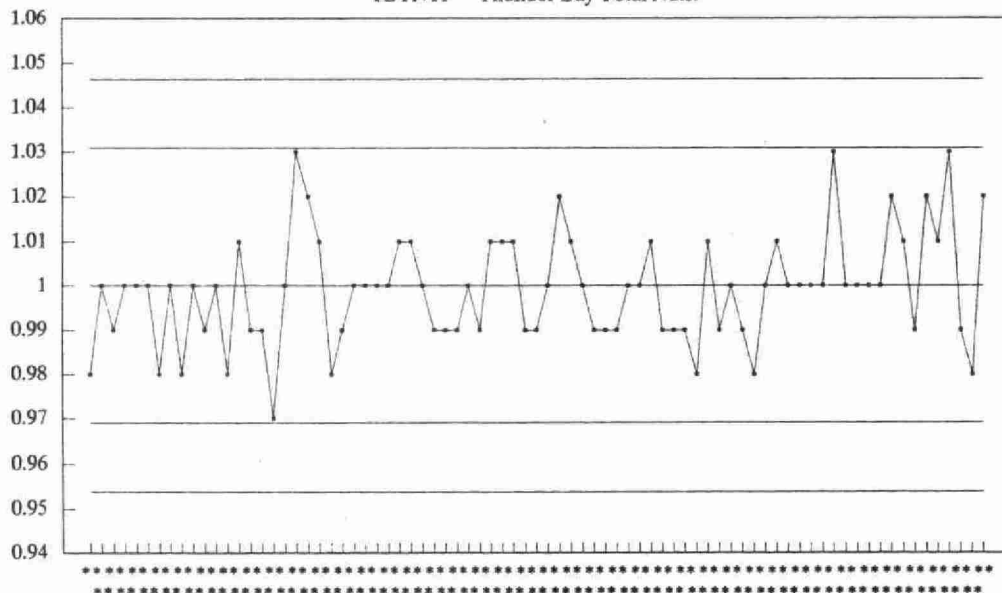


QCA+QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

NNTKUR Nitr'n, Total Kjeld, Unf

TBTNTP Thunder Bay Total Nuts.



QCA-QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

***** TOTAL PHOSPHORUS *****

IDENTIFICATION:

LIS Test Name Code: PPUT	Introduced	: 1978
Work Station Code : TBTNTP	Units	: mg/L as P
Method Code : E6026A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface and domestic waters, precipitation, sewages, landfill leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container	: Glass or PET jar.
Preservative	: Refrigerate at 4°C.

ANALYTICAL PROCEDURE:

Samples are digested stepwise in a sulphuric acid-mercuric oxide-potassium sulphate media using two block digesters set at 200°C and 360°C. The orthophosphate content in the digestate is determined by the formation of a reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

N.B. Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI. Colourimetric measurement is through a 5.0 cm. light path at 880 nm. Data capture and processing via a multi-stage microcomputer system.

CALIBRATION:

- Linear
- 7 Standards 0 - 0.16 mg/L

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB
Drift : BLK every 10 samples, CHK (100%) every 20 samples
Duplicates : DUP (3 per run, run at beginning)

Reporting: Maximum Significant Figures: 3
W Value: 0.001 T Value: 0.005

CAEAL Certified and QM Blind Audit participant

MODIFICATIONS:

February 1989 - Both channels went to microcomputer control with DCI software.

TOTAL PHOSPHORUS

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 0.16 mg/L as P

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	79	0.15	0.150	0.000	0.0010
QCB:	79	0.05	0.050	0.000	0.0014
QCA+QCB:	79	0.20	0.200	0.000	0.0021
QCA-QCB:	79	0.10	0.100	0.000	0.0012

For 1992 Control Charts:

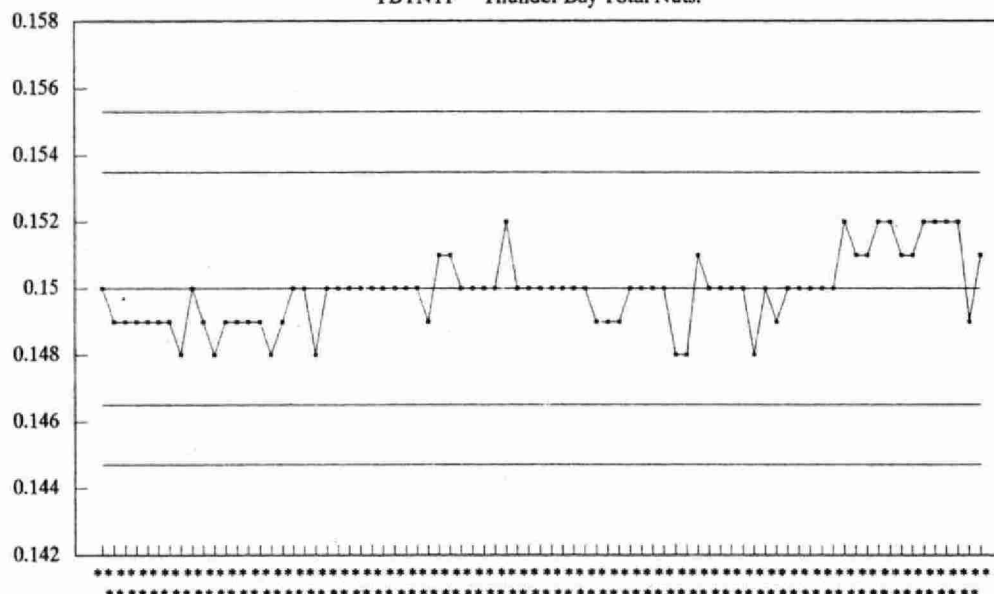
$$Sw (A-B) = 0.0018$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
118	0.000 – 0.032	0.013	0.0018
58	0.032 – 0.080	0.057	0.0042
24	0.080 – 0.160	0.106	0.0048

PPUT Phosphorus, Unf. Total

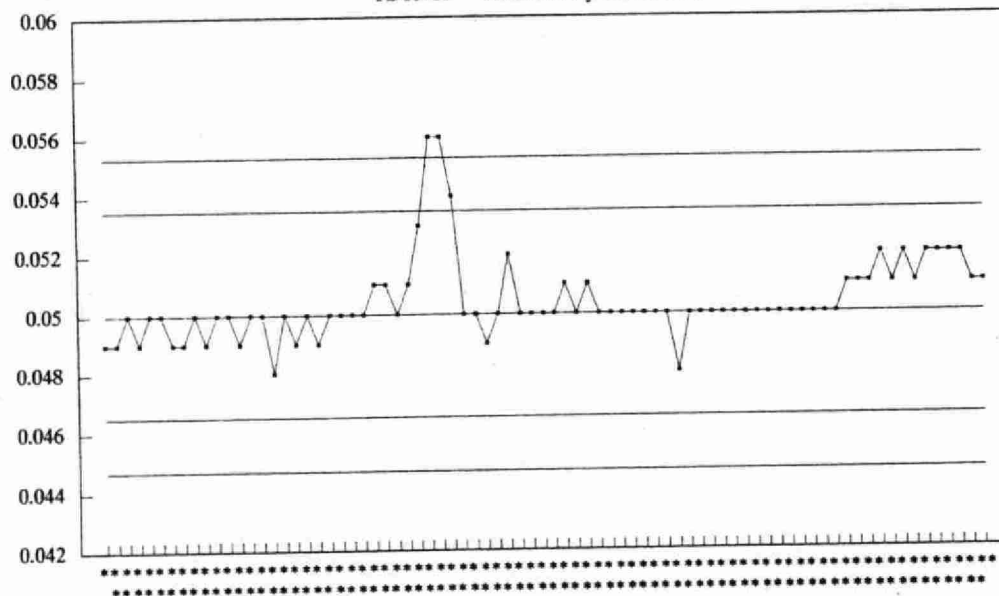
TBTNTP Thunder Bay Total Nuts.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

PPUT Phosphorus, Unf. Total

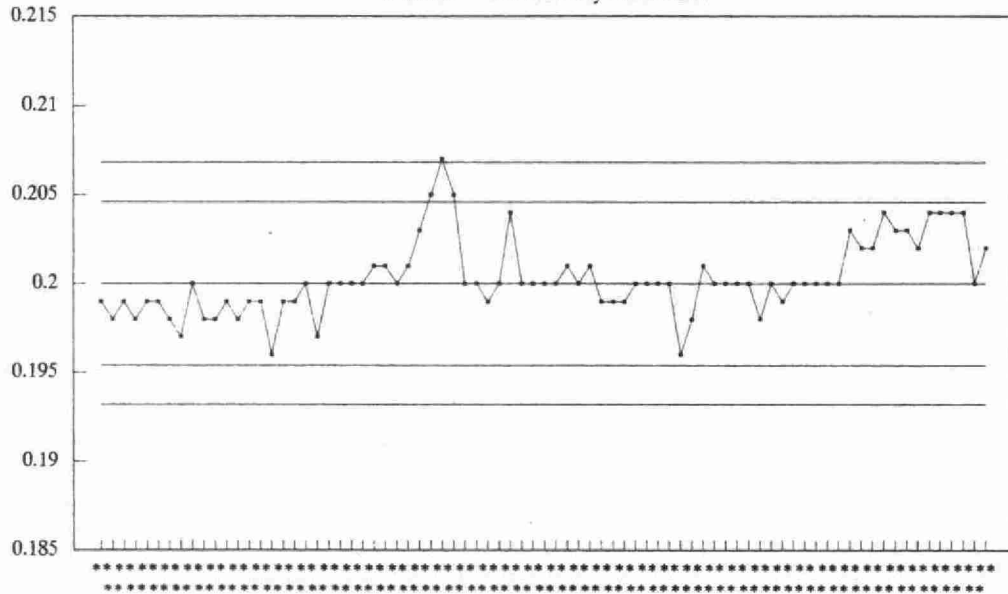
TBTNTP Thunder Bay Total Nuts.



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

PPUT Phosphorus, Unf. Total

TBTNTP Thunder Bay Total Nuts.

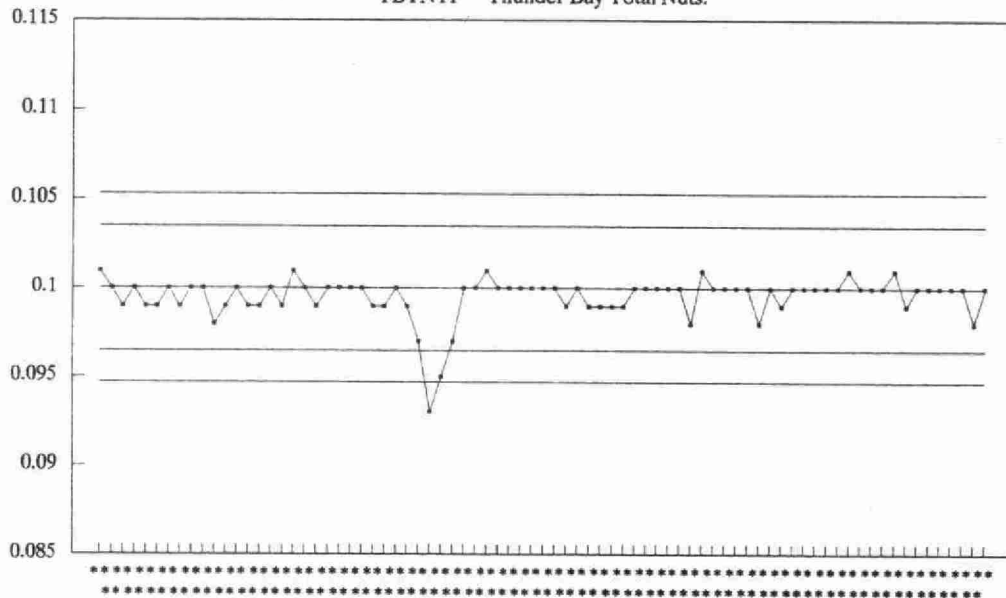


QCA+QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

PPUT Phosphorus, Unf. Total

TBTNTP Thunder Bay Total Nuts.



QCA-QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5033 - 7621

***** TOTAL SOLIDS - IGNITED *****

IDENTIFICATION:

LIS Test Name Code: RSTA,RSTLOI	Introduced	: 1980
Work Station Code : TBRTI	Units	: mg/L
Method Code : E6029A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Sewages, precipitation, industrial effluents and landfill leachates.

SAMPLING:

Special Instructions:

Container	: PET or glass
Preservative	: Refrigerate at 4°C

ANALYTICAL PROCEDURE:

The procedure for total solids is followed and the dried residue is ignited at 600°C for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ignited or ash weight is obtained as the difference between the final ignited weight and the original dish weight. The volume used in the ignited calculations is the volume selected for the original total solids calculation. Data collection, calculations and transfer of results are controlled by a microcomputer system.

INSTRUMENTATION:

Balance (5 place), drying oven, muffle furnace, micro-computer system with appropriate software.

CALIBRATION:

- Balance internal calibration, tare

CONTROLS AND QUALITY ASSURANCE:

Calibration: 2 S class weights
Drift : Balance zero (auto. checked every 4th measurement)
Duplicates : DUP (1 for every 10 samples)

Reporting:	Maximum Significant Figures: Whole numbers	
Ashed	W Value: 20	T Value: 100
Loss	W Value: 20	T Value: 100

MODIFICATIONS:

September, 1984 - Commodore computer set up for input.
September, 1988 - Direct Computer Input with Commodore computer.
June, 1989 - Microcomputer and in-house Lotus program replaces Commodore computer.

TOTAL SOLIDS – IGNITED

Quality Control Data from January 1 to December 31, 1992

DRIED

Analytical Range – to 20 000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
6	0 – 4000	2798.833	16.8572
6	4000 – 10000	7801.333	71.4971
24	10000 – 20000	12658.540	156.9573

ASHED

Analytical Range – to 10 000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
15	0 – 2000	1467.333	10.8735
8	2000 – 5000	3927.250	31.6583
15	5000 – 10000	6474.200	72.5854

LOSS

Analytical Range – to 20 000 mg/L

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
7	0 – 4000	1703.285	12.0564
25	4000 – 10000	6973.600	107.9875
12	10000 – 20000	13027.660	118.6640

***** TRUE COLOUR *****

IDENTIFICATION:

LIS Test Name Code: COLTR	Introduced	: 1978
Work Station Code : TBCOLTR	Units	: TCU
Method Code : E6004A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, leachates and industrial effluents.

SAMPLING:

Special Instructions:

Container : Glass or PET jar.
Preservative : Refrigerated at 4°C.

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

INSTRUMENTATION:

Automated continuous flow system, Technicon AAI. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450 nm.) Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm).

CALIBRATION:

- Linear
- 4 Standards, 0 - 10.0 TCU range
- 10 Standards, 2.0 - 80.0 TCU range

CONTROLS AND QUALITY ASSURANCE:

Calibration: LTB, QCA, QCB, QCC

Drift : BLK every 10 samples, 10 and 60 STD every 20 samples

Duplicates : DUP (1 per 20 samples, run at beginning)

Reporting: Maximum Significant Figures: 2
W Value: 0.5 T Value: 2.5

LRTAP Participant

MODIFICATIONS:

Aug. 1985 - Apparent colour method upgraded to present method.
Feb. 1990 - Quality Control Standards changed from 2 samples to 3.

TRUE COLOUR

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 80 TCU

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	49	70	69.042	-0.958	0.6663
QCB:	49	25	25.108	0.108	0.3093
QCC:	49	7	6.666	-0.334	0.2749
QCA+QCB:	49	95	94.149	-0.851	0.8468
QCA-QCB:	49	45	43.934	-1.066	0.6019
QCB+QCC:	49	32	31.773	-0.227	0.5332
QCB-QCC:	49	18	18.442	0.442	0.2413

For 1992 Control Charts:

$$Sw (A-B) = 0.4992$$

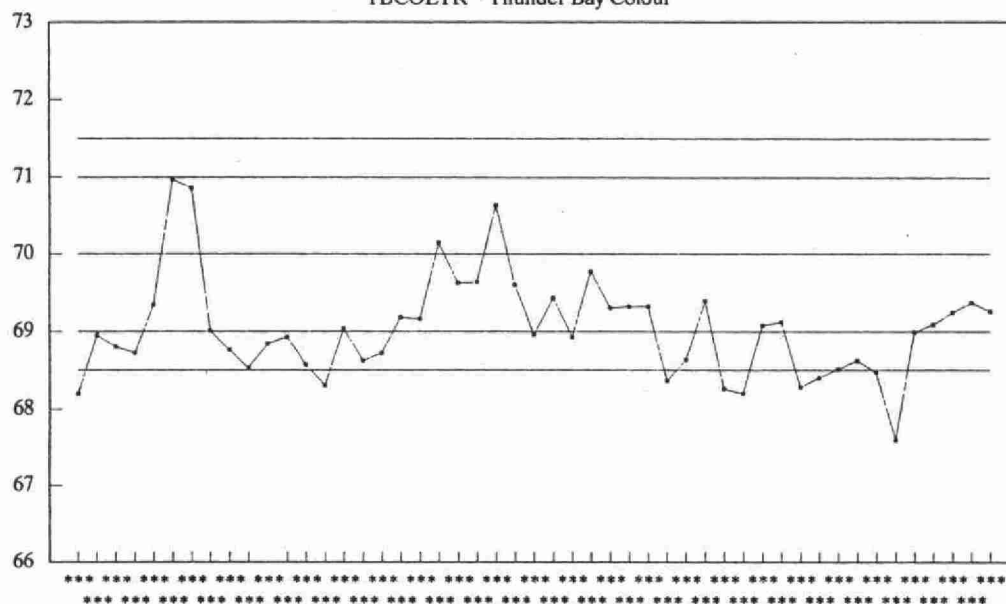
$$Sw (B-C) = 0.5555$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
160	0 – 16	5.828	0.5420
45	16 – 40	25.456	0.7295
19	40 – 80	52.786	0.5035

COLTR Colour True

TBCOLTR Thunder Bay Colour

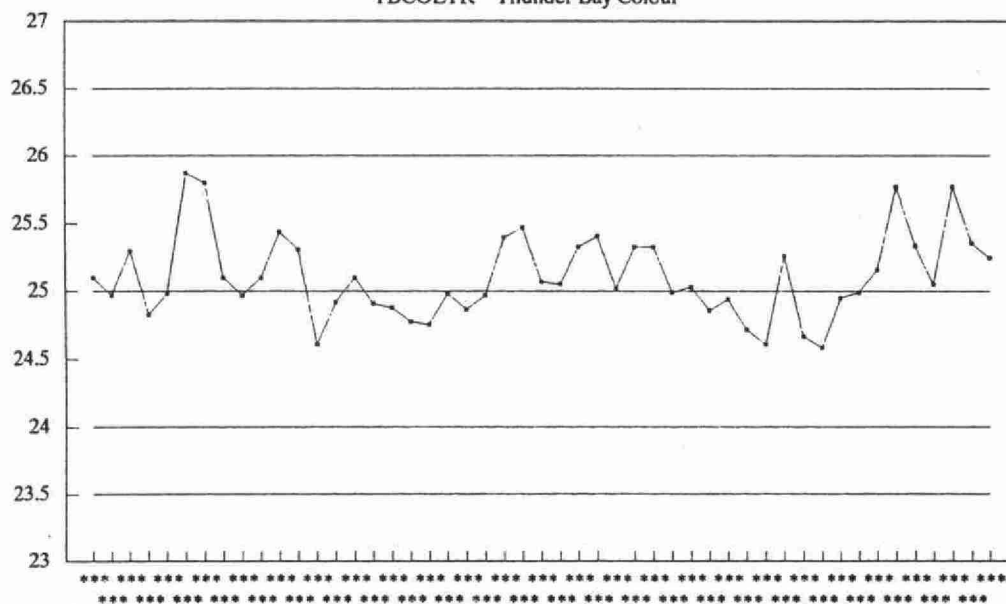


— QCA

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

COLTR Colour True

TBCOLTR Thunder Bay Colour

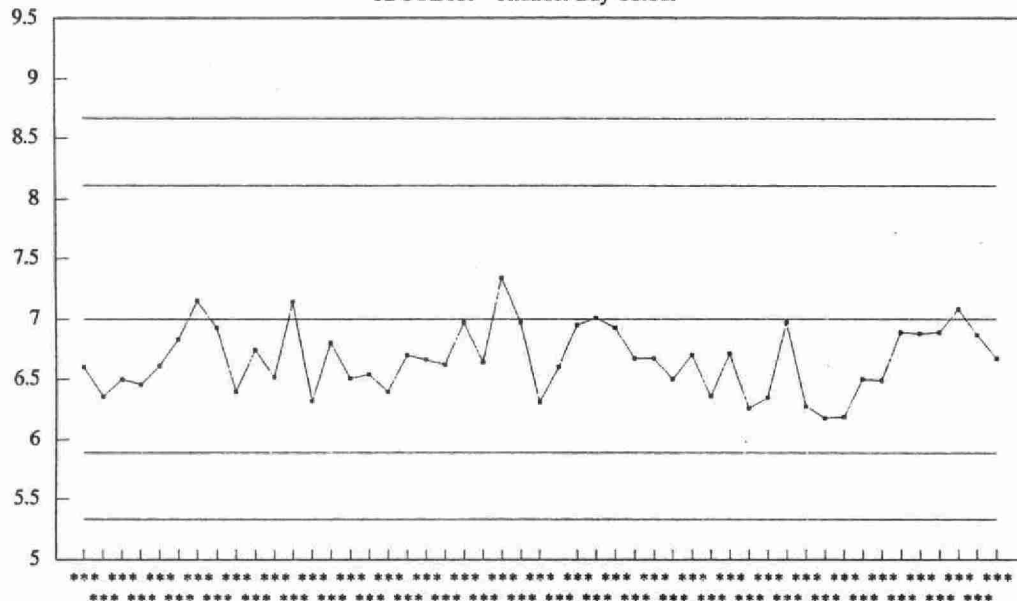


— QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

COLTR Colour True

TBCOLTR Thunder Bay Colour

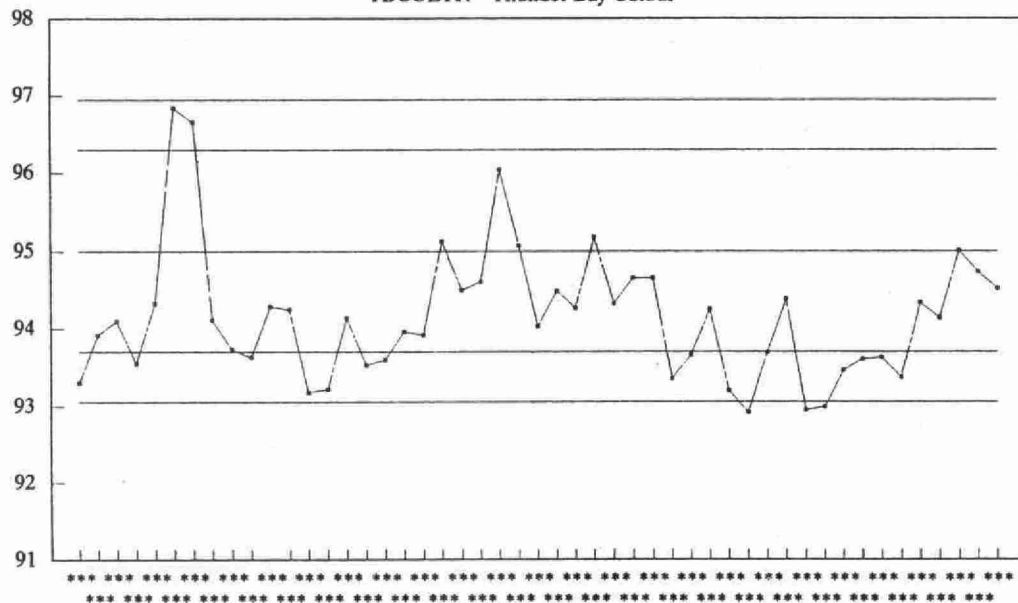


Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

— QCC

COLTR Colour True

TBCOLTR Thunder Bay Colour

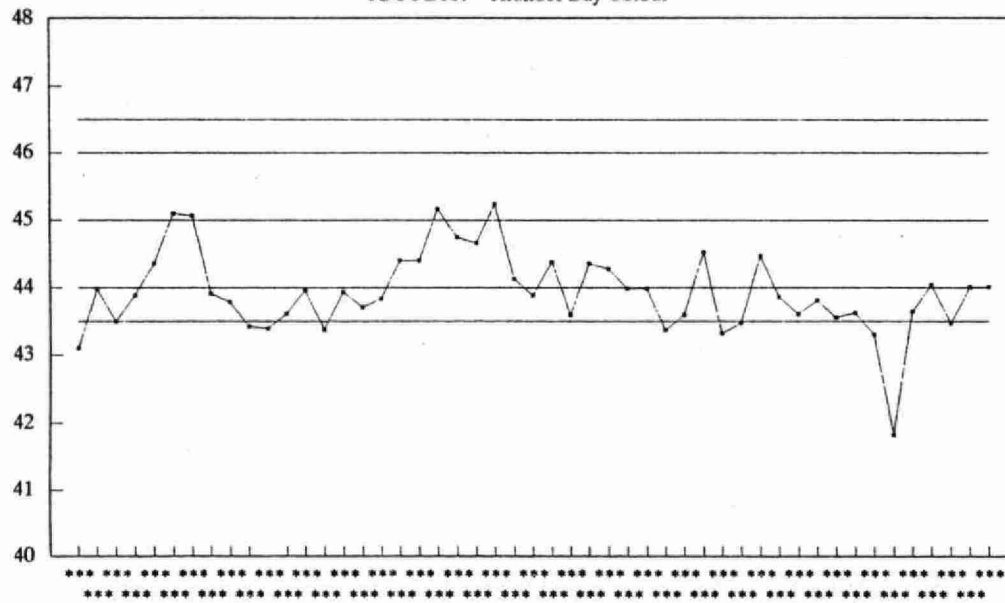


Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

— QCA+QCB

COLTR Colour True

TBCOLTR Thunder Bay Colour

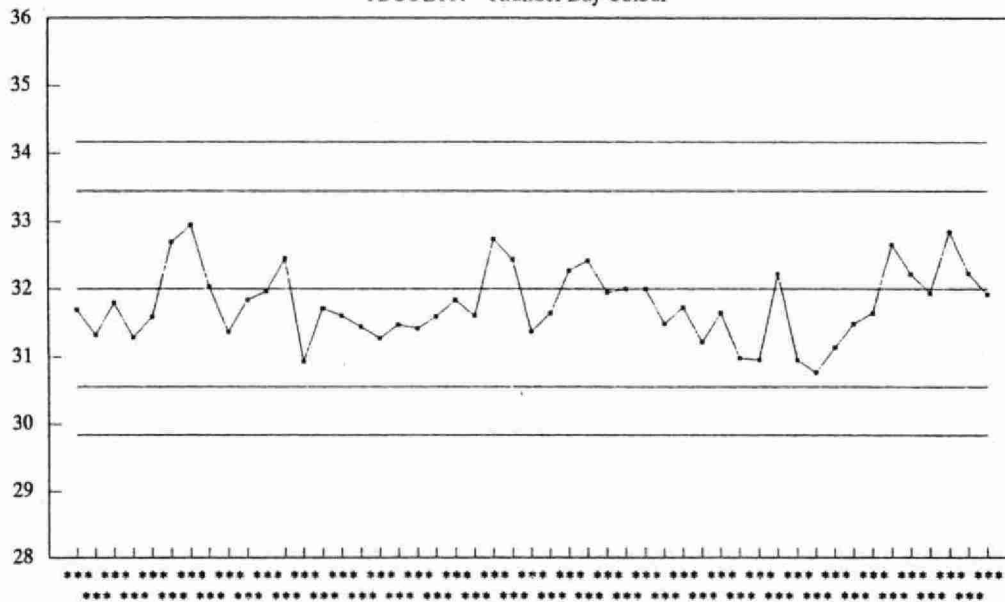


— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

COLTR Colour True

TBCOLTR Thunder Bay Colour

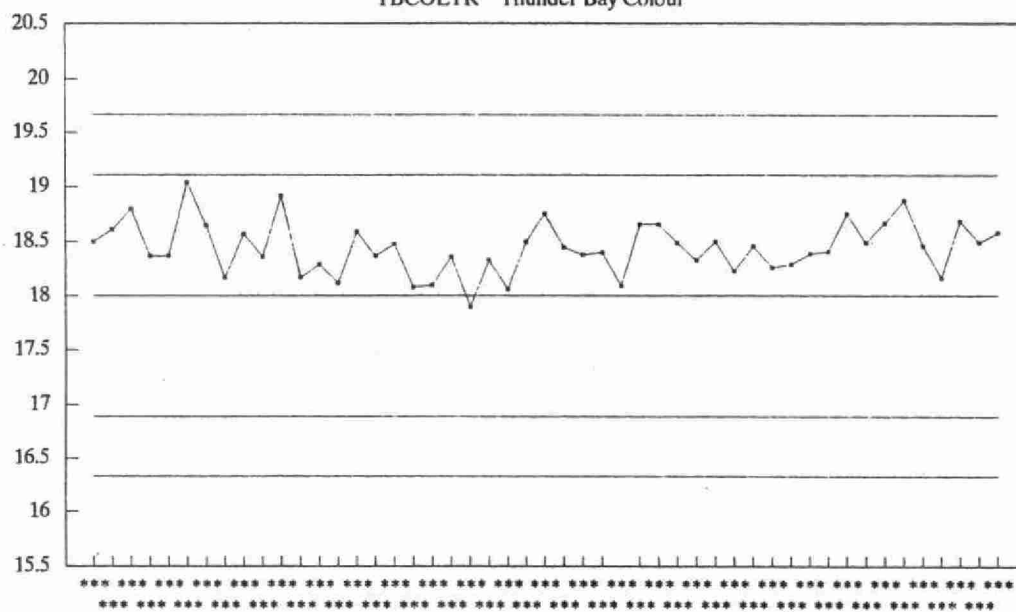


— QCB+QCC

Jan. 01, 1992 – Dec. 31, 1992
Runs: 5079 – 7661

COLTR Colour True

TBCOLTR Thunder Bay Colour



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5079 - 7661

→ QCB-QCC

***** TURBIDITY *****

IDENTIFICATION:

LIS Test Name Code: TURB	Introduced	: 1978
Work Station Code : TBTURB	Units	: FTU
Method Code : E6011A	Section	: Water Quality

SAMPLE TYPE/MATRIX:

Surface water, domestic water, precipitation, industrial effluent and landfill leachate.

SAMPLING:

Special Instructions: Avoid freezing
Container : PET or glass
Preservative : Refrigerate at 4°C in dark

ANALYTICAL PROCEDURE:

Samples are placed in the turbidimeter and results in FTU are read directly from the digital output.

INSTRUMENTATION:

Hach Ratio Turbidimeter, Model 18900. Turbidity measurements are based on light scattering at 90 degrees plus or minus 30 degrees of rotation.

CALIBRATION:

- Calibrated every 6 months using 11 Stock Formazin Standards ranging from 0.4 to 180 FTU.

CONTROLS AND QUALITY ASSURANCE:

Calibration: QCA, QCB (Sealed Hach 'Gelex' Standard)
Drift : QCA, QCB - at end of run
Duplicates : DUPS (1 for every 15 samples, run at beginning)

Reporting: Maximum Significant Figures: 2
W Value: .02 T Value: .10

MODIFICATIONS:

March 1987 - New Hach Ratio Turbidimeter put into use to replace older Hach model.
January 1990 - New Hach 'Gelex' Standards were put into use after re-calibration of the Hach Model 18900 Turbidimeter.

TURBIDITY

Quality Control Data from January 1 to December 31, 1992

Analytical Range – to 10 FTU

Calibration Control:

	Number of Data	Expected Conc.	Avg. Conc. Measured	Average Bias	Standard Deviation
QCA:	44	15.219	15.250	0.031	0.1089
QCB:	44	1.496	1.496	0.001	0.0202
QCA+QCB:	44	16.714	16.746	0.032	0.1198
QCA-QCB:	44	13.723	13.754	0.030	0.1009

For 1992 Control Charts:

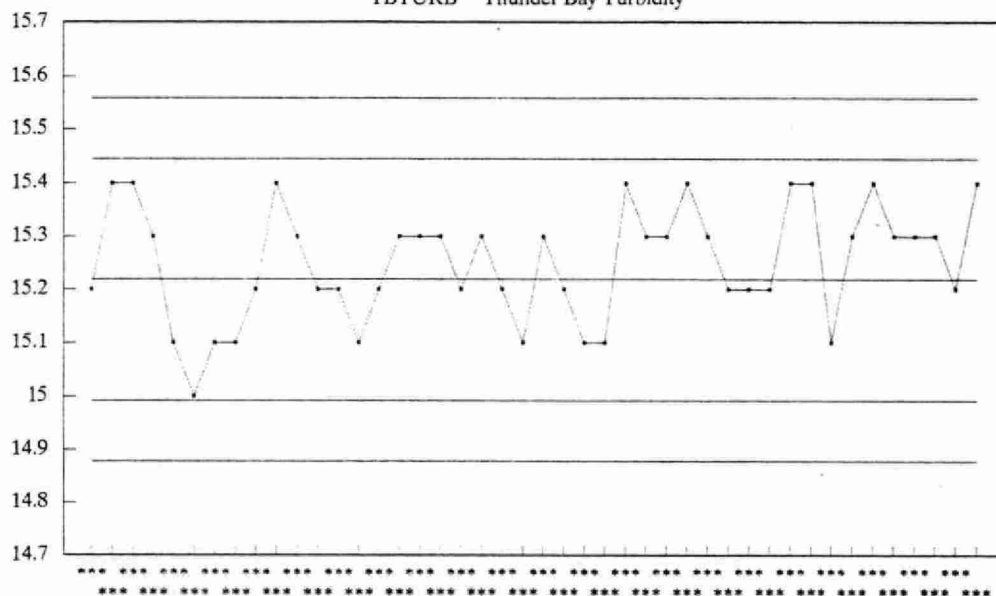
$$Sw (A-B) = 0.1133$$

Duplicates:

Number of Data Pairs	Sample Conc Span	Mean Value	Standard Deviation
146	0 – 2	0.810	0.0752
51	2 – 5	3.322	0.2005
19	5 – 10	7.389	0.2317

TURB Turbidity

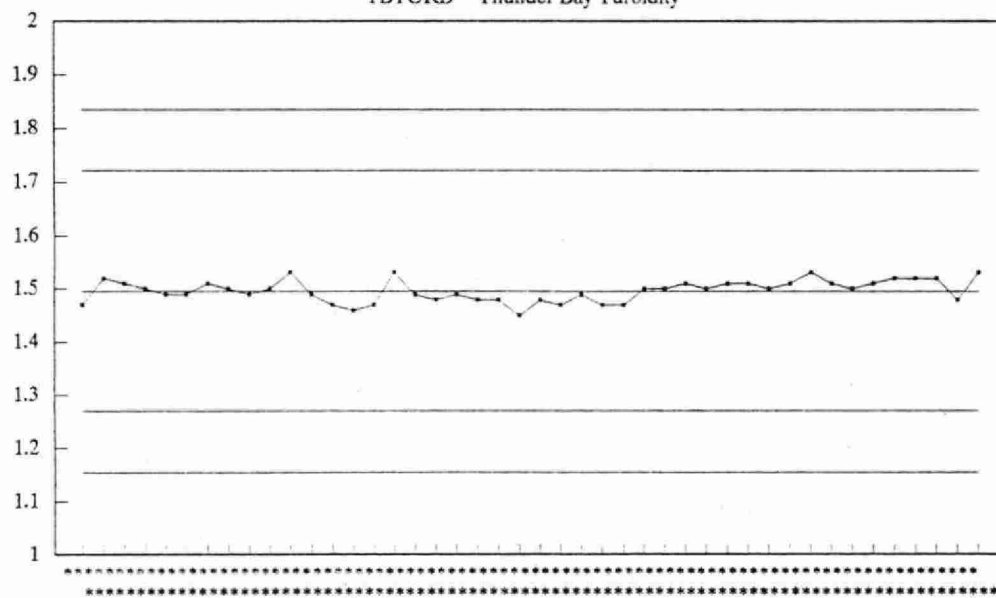
TBTURB Thunder Bay Turbidity



Jul. 22, 1992 - Dec. 31, 1992
Runs: 6538 - 7684

TURB Turbidity

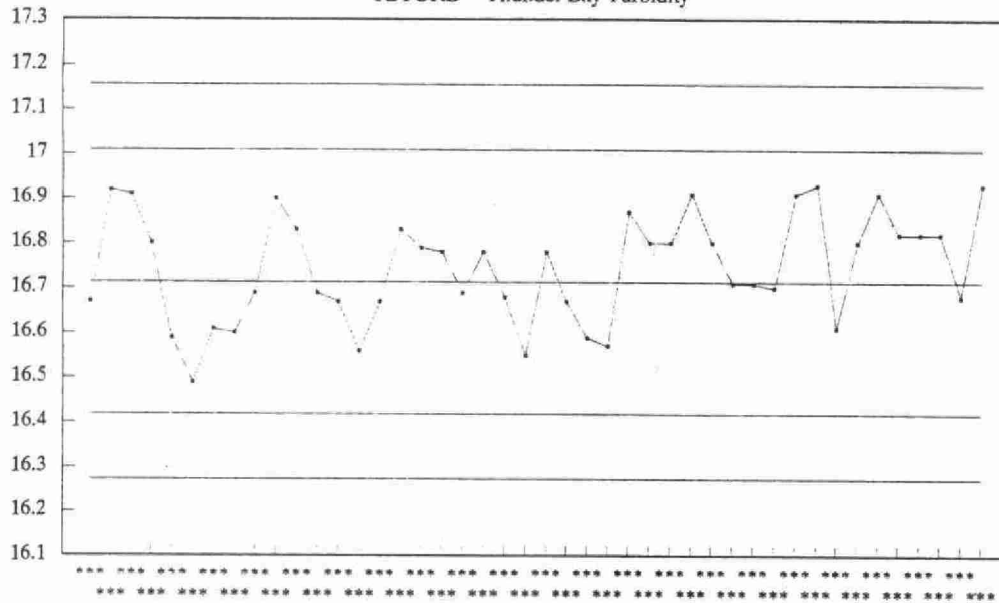
TBTURB Thunder Bay Turbidity



Jul. 22, 1992 - Dec. 31, 1992
Runs: 6538 - 7684

TURB Turbidity

TBTURB Thunder Bay Turbidity

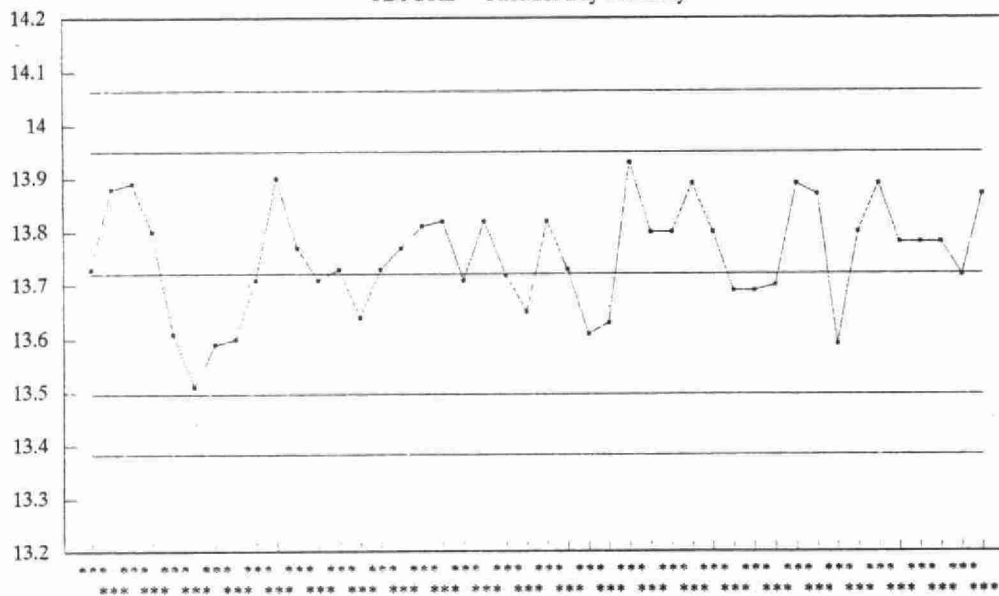


QCA+QCB

Jul. 22, 1992 - Dec. 31, 1992
Runs: 6538 - 7684

TURB Turbidity

TBTURB Thunder Bay Turbidity



QCA-QCB

Jul. 22, 1992 - Dec. 31, 1992
Runs: 6538 - 7684

5.0

Trace Contaminants Performance Summaries

TRACE METALS

IDENTIFICATION:

Method Title: The Determination of Trace Metals in Surface Waters by Preconcentration and ICP-AES.

WorkStation: TBMPRE
Method Code: E6043A

Section: Trace Contaminants
Method Introduced: May/88

PARAMETERS:	<u>LIS Code</u>	<u>W (ug/L)</u>	<u>T(ug/L)</u>
Aluminum	ALUT	5.0	25.0
Barium	BAUT	1.0	5.0
Beryllium	BEUT	1.0	5.0
Cadmium	CDUT	0.20	1.0
Cobalt	COUT	1.0	5.0
Copper	CUUT	0.5	2.5
Chromium	CRUT	1.0	5.0
Iron	FEUT	5.0	25.0
Manganese	MNUT	1.0	5.0
Molybdenum	MOUT	0.5	2.5
Nickel	NIUT	1.0	5.0
Lead	PBUT	2.0	10.0
Strontium	SRUT	1.0	5.0
Titanium	TIUT	1.0	5.0
Vanadium	VVUT	2.0	10.0
Yttrium	YYUT	1.0	5.0
Zinc	ZNUT	1.0	5.0
Silver	AGUT	0.5	2.5

SAMPLE TYPE/MATRIX:

'Clean' samples such as drinking water, surface water and groundwater.

ANALYTICAL PROCEDURE:

Samples are subjected to nitric acid digestion/preconcentration followed by analysis by ICP-AES.

INSTRUMENTATION:

Thermo Jarrell Ash (ICAP61) Inductively Coupled Plasma Spectrometer; Linear, two-point calibration.

QUALITY ASSURANCE:

Controls: Blank, QCC, QCD

Ref. Materials: EPA Trace Metals
EPA ICAP 7
EPA ICAP 19

Drift: QCD, QCE analyzed every 20 samples

Duplicates: 1 per 20 samples

Interlabs: MOEE Blind Audit Program (Bimonthly)
Great Lakes Action Program (GLAP, 2x annually)
CAEAL Certification Program (2x annually)

Reporting: Units: ug/L (ppb)
Sig. Figures: 2

REMARKS: Method detection limits under review based on accumulated QA data. Review expected to be completed October 1993.

ALUMINUM (TOTAL) – ALUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 5 – 50,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	10.000	9.826	98.3	2.2
QCD:	195	2.000	1.962	98.1	3.5
QCC+QCD:	195	12.000	11.788	98.2	2.1
QCC–QCD:	195	8.000	7.865	98.3	2.5

For 1993 Control Limits:

$$Sw (C-D) = 0.1993$$

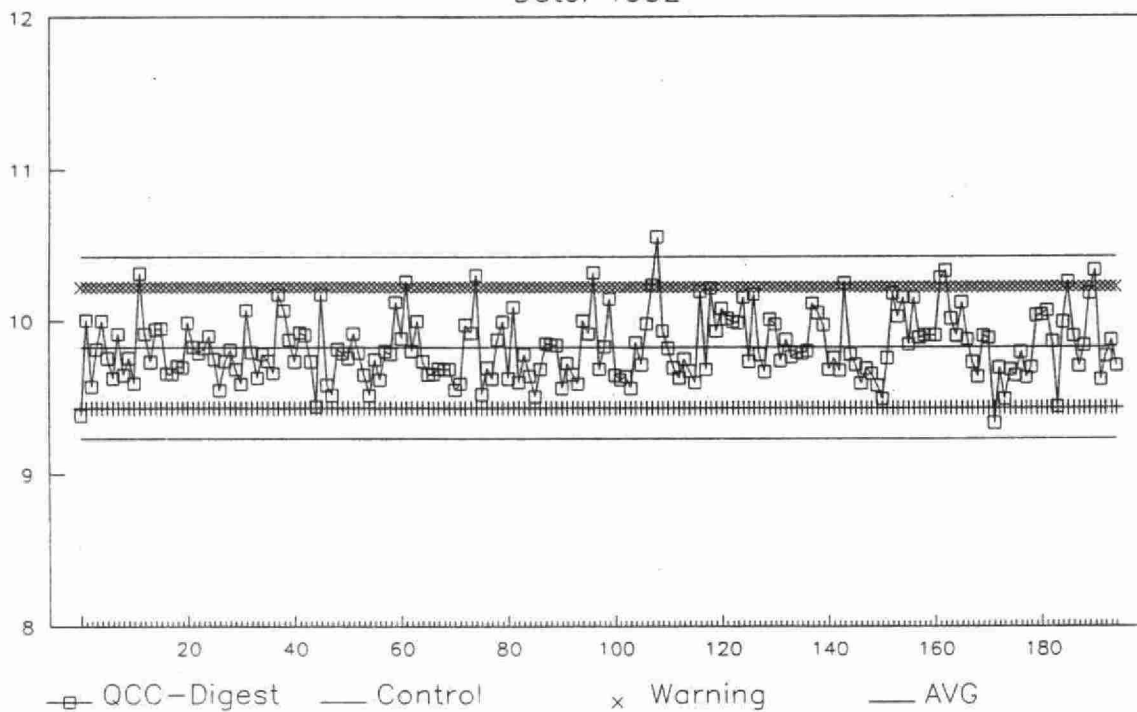
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
136	5	500	71.34	4.2290
15	500	5000	1578.9	166.60
N/A	5000	50000	–	–

$$\text{Detection Limit (DL)} = 5 \text{ ug/L}$$

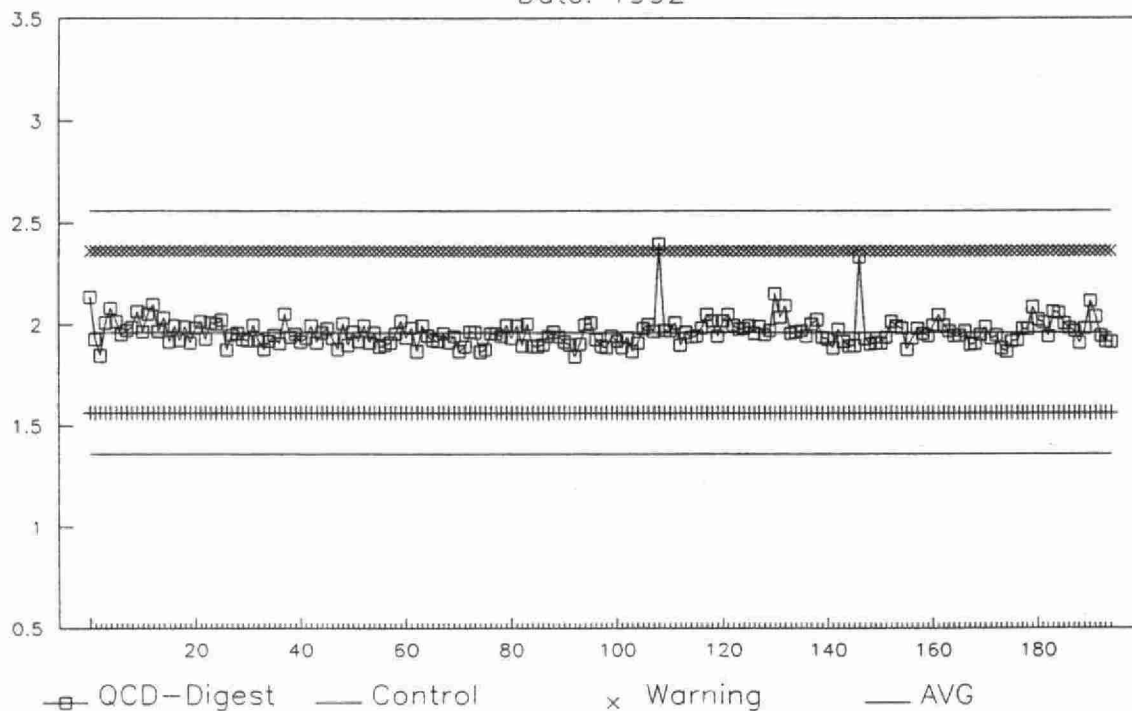
QCC Data — AI

Date: 1992



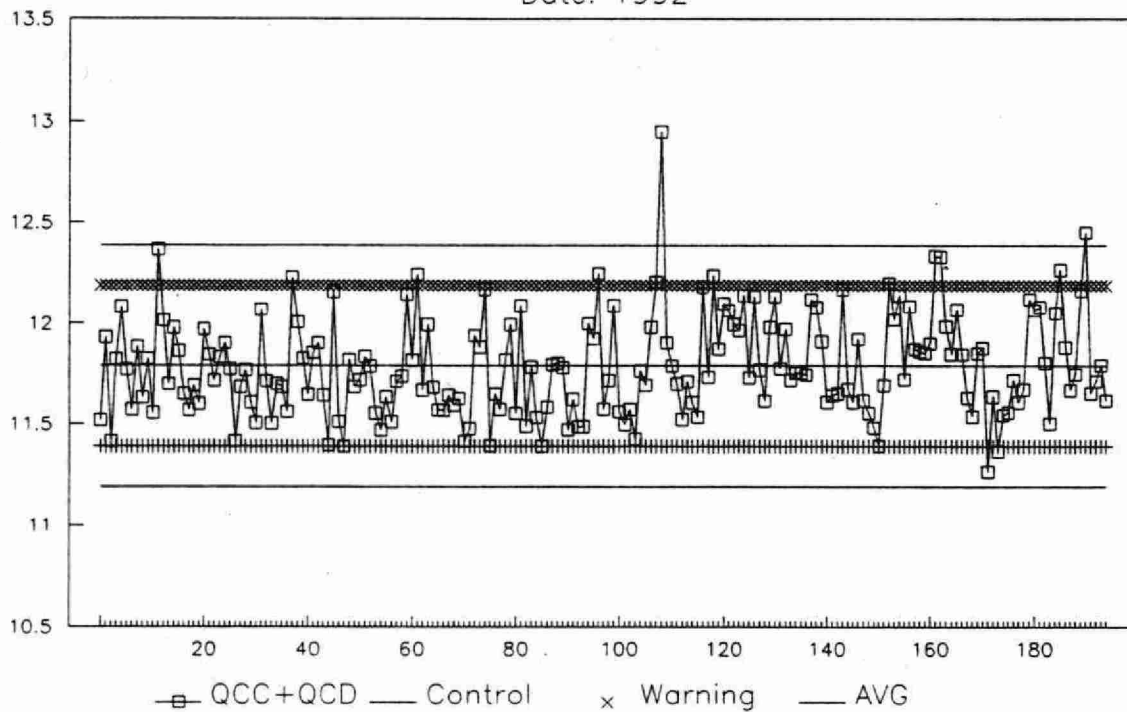
QCD Data — AL

Date: 1992



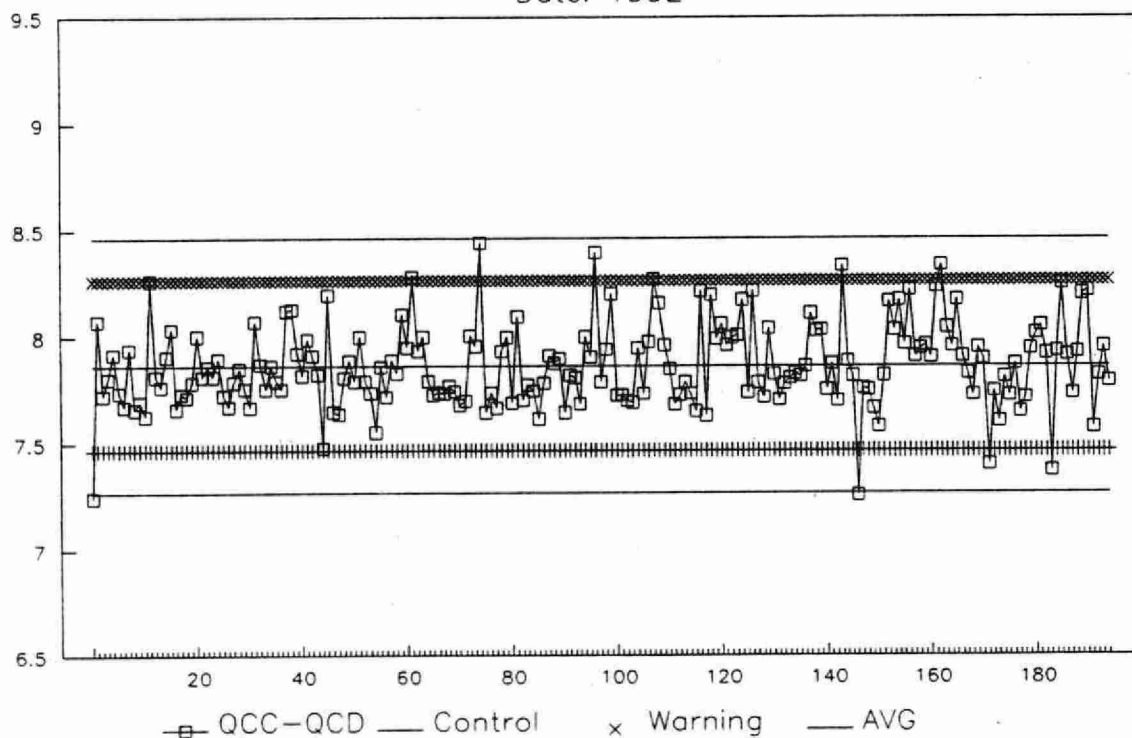
QC Sum Plot — AI

Date: 1992



QC Difference Plot — aL

Date: 1992



BARIUM (TOTAL) – BAUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 5 – 100,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	193	1.000	0.988	98.8	2.4
QCD:	193	0.200	0.198	99.0	3.1
QCC+QCD:	193	1.200	1.187	98.9	2.3
QCC–QCD:	193	0.800	0.790	98.8	2.7

For 1993 Control Limits:

$$Sw (C-D) = 0.0212$$

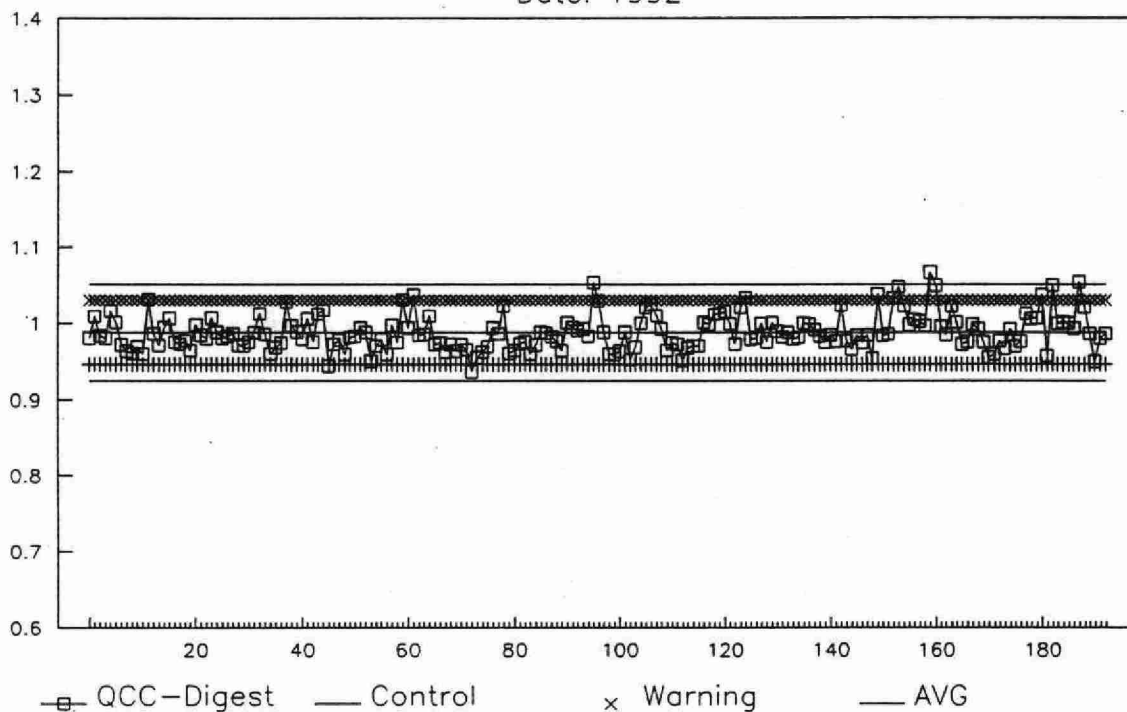
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
146	1	100	19.54	1.0795
8	100	1000	229.0	3.96
N/A	1000	10000	–	–

$$\text{Detection Limit (DL)} = 1 \text{ ug/L}$$

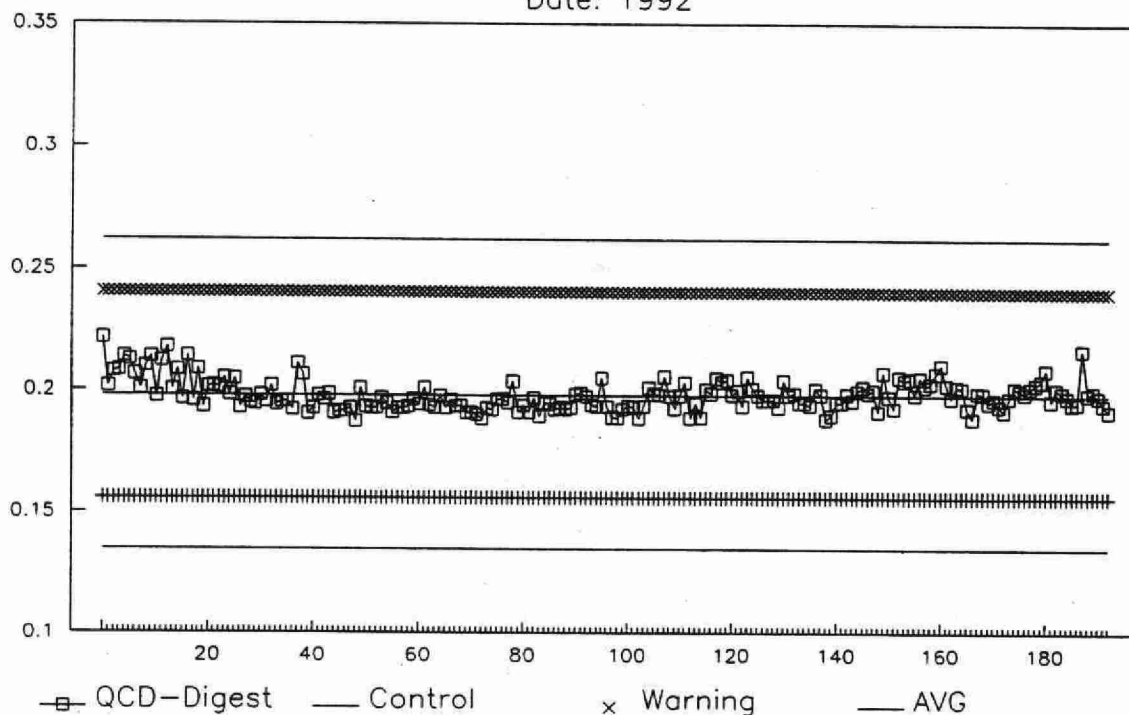
QCC Data — Ba

Date: 1992



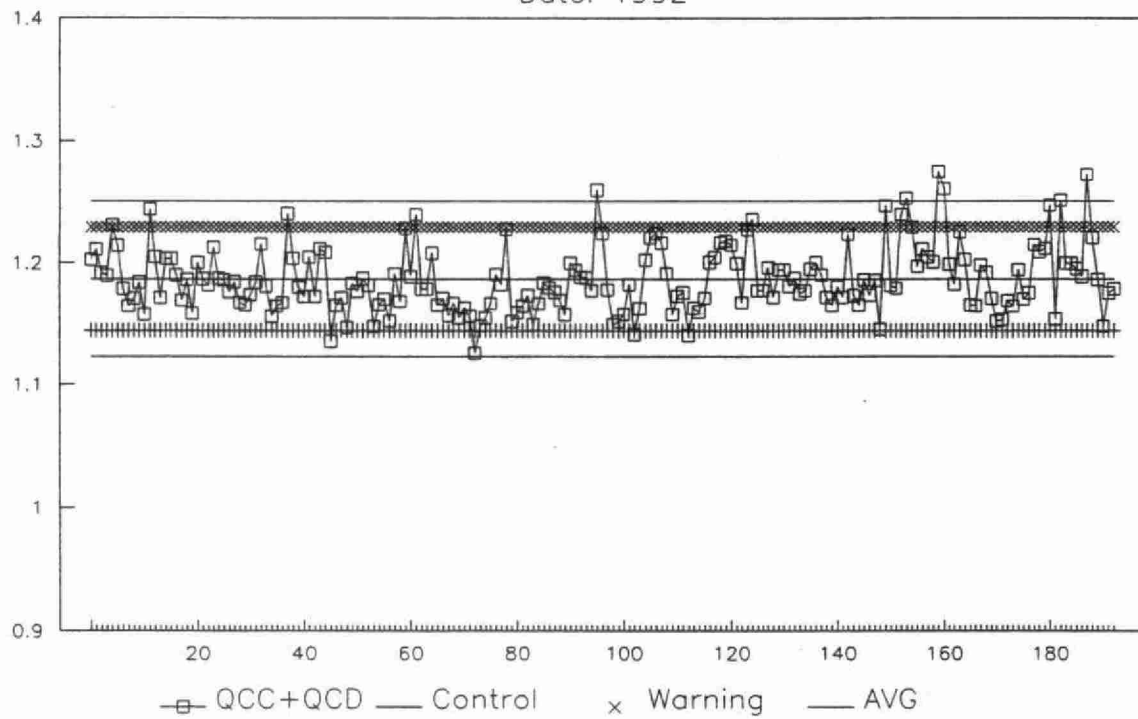
QCD Data — Ba

Date: 1992



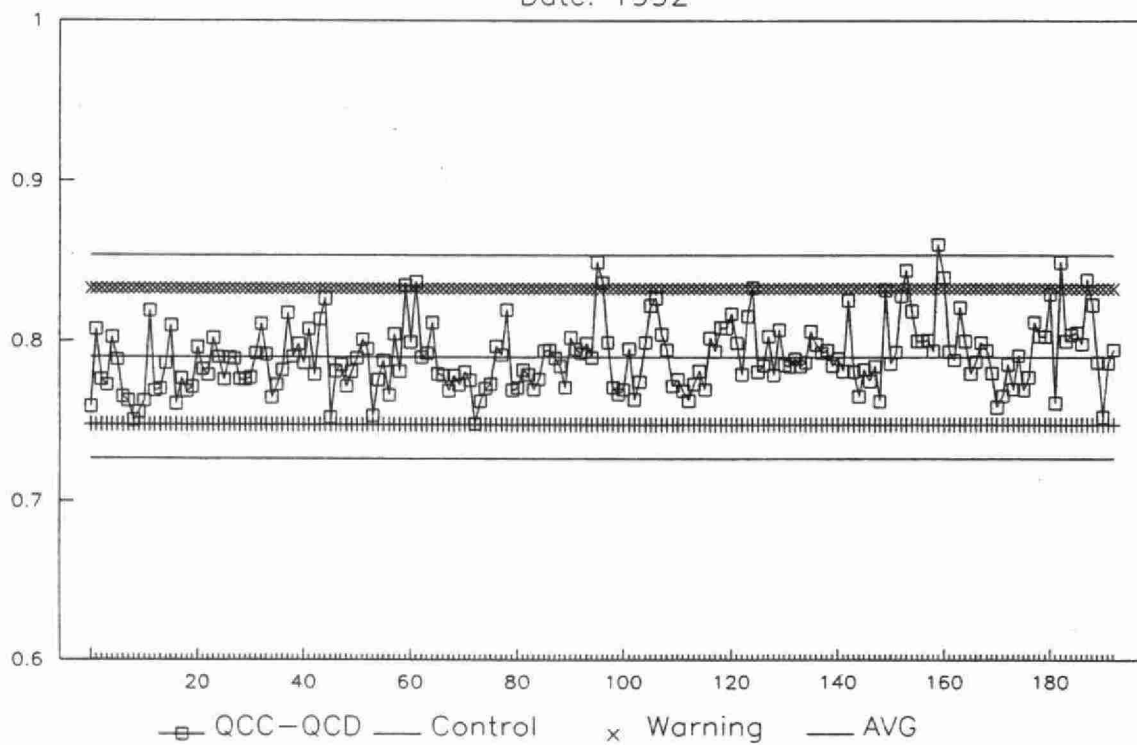
QC Sum Plot — Ba

Date: 1992



QC Difference Plot — Ba

Date: 1992



BERYLLIUM (TOTAL) – BEUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 10,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	2.000	1.919	96.0	2.2
QCD:	195	0.400	0.383	95.8	2.2
QCC+QCD:	195	2.400	2.302	95.9	2.1
QCC–QCD:	195	1.600	1.536	96.0	2.4

For 1993 Control Limits:

$$Sw (C-D) = 0.0367$$

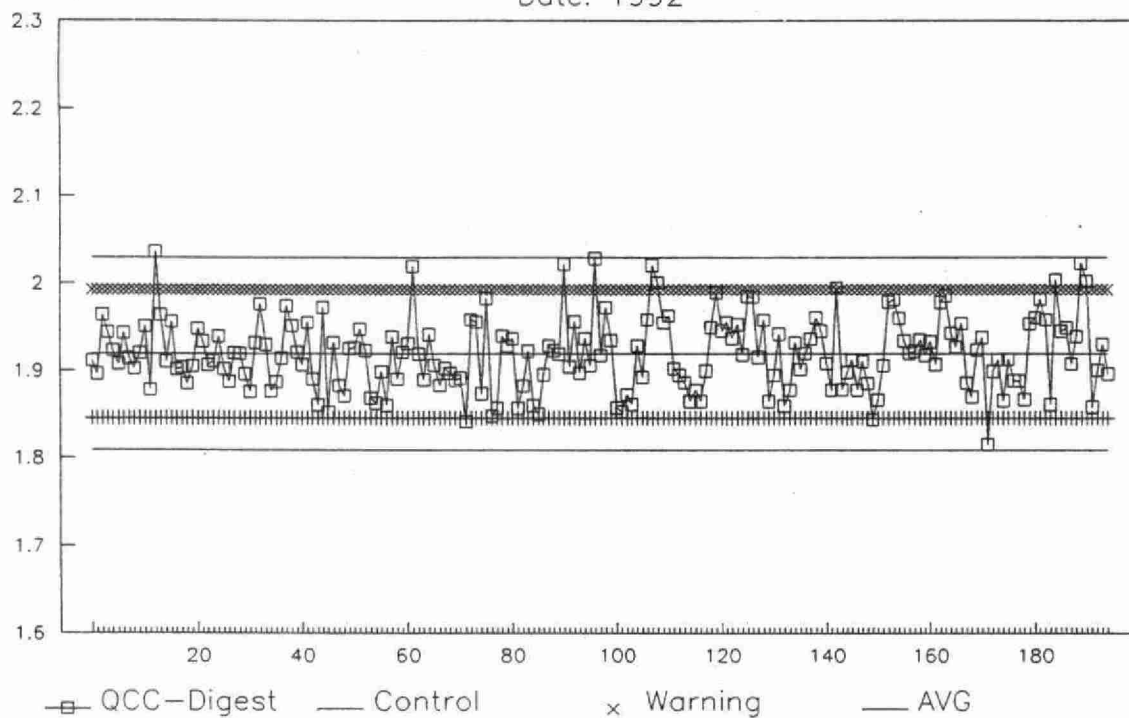
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
154	1	100	0.08	0.0231
N/A	100	1000	–	–
N/A	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

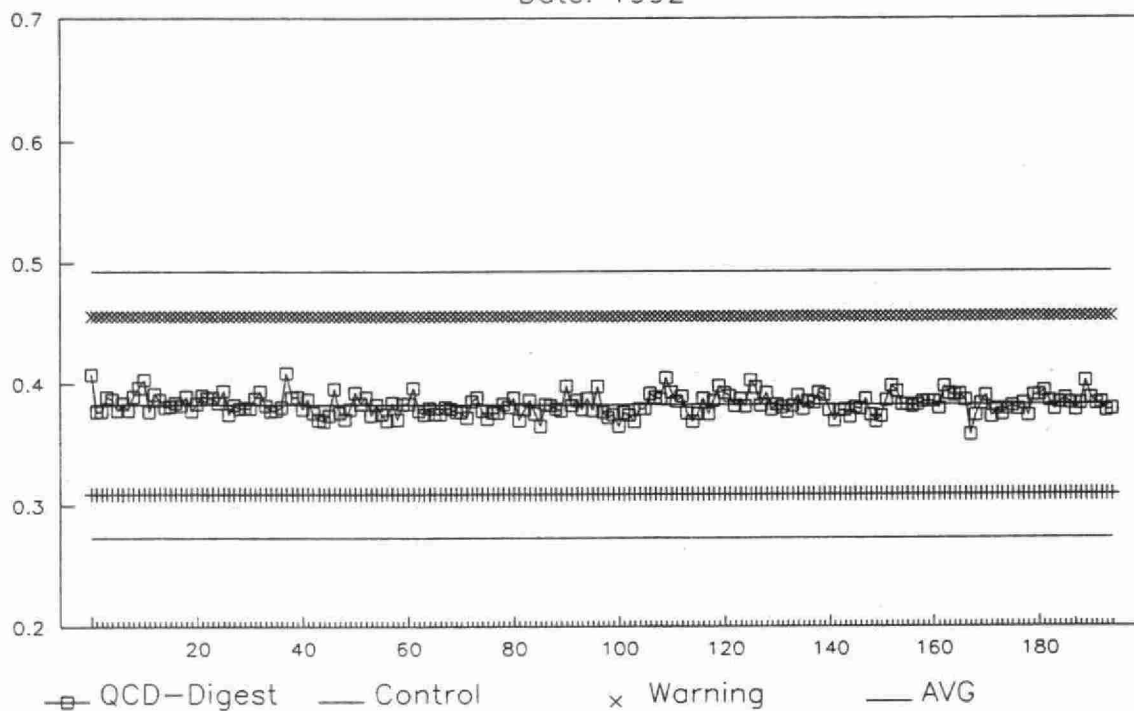
QCC Data — Be

Date: 1992



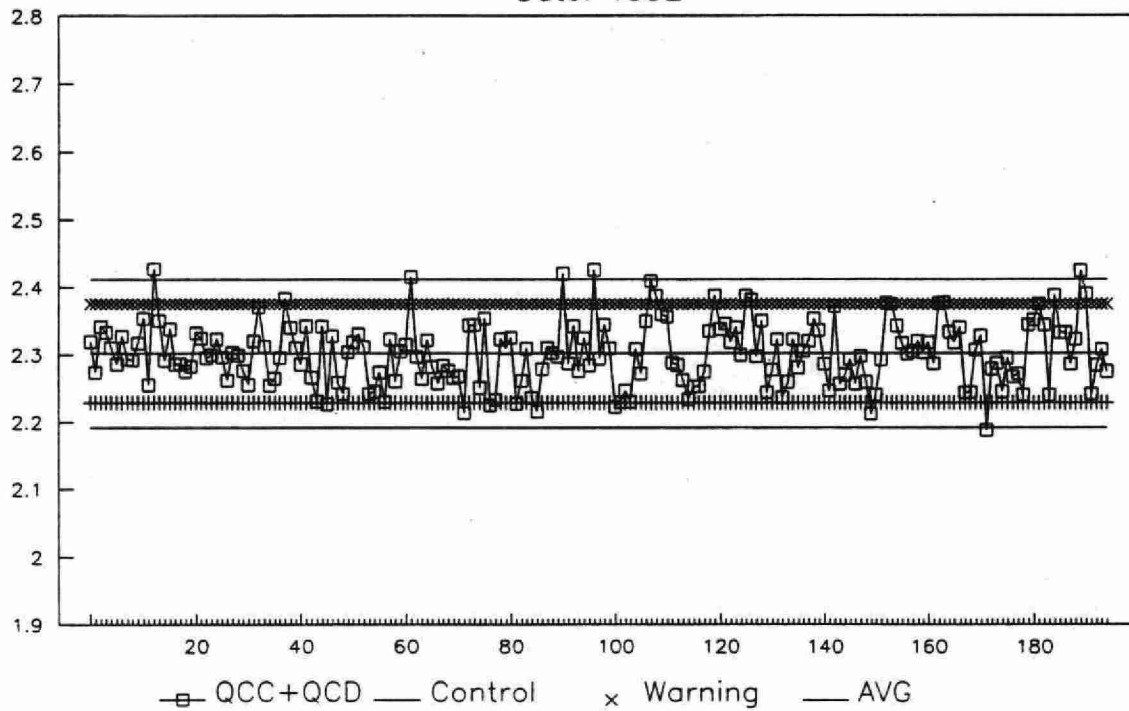
QCD Data — Be

Date: 1992



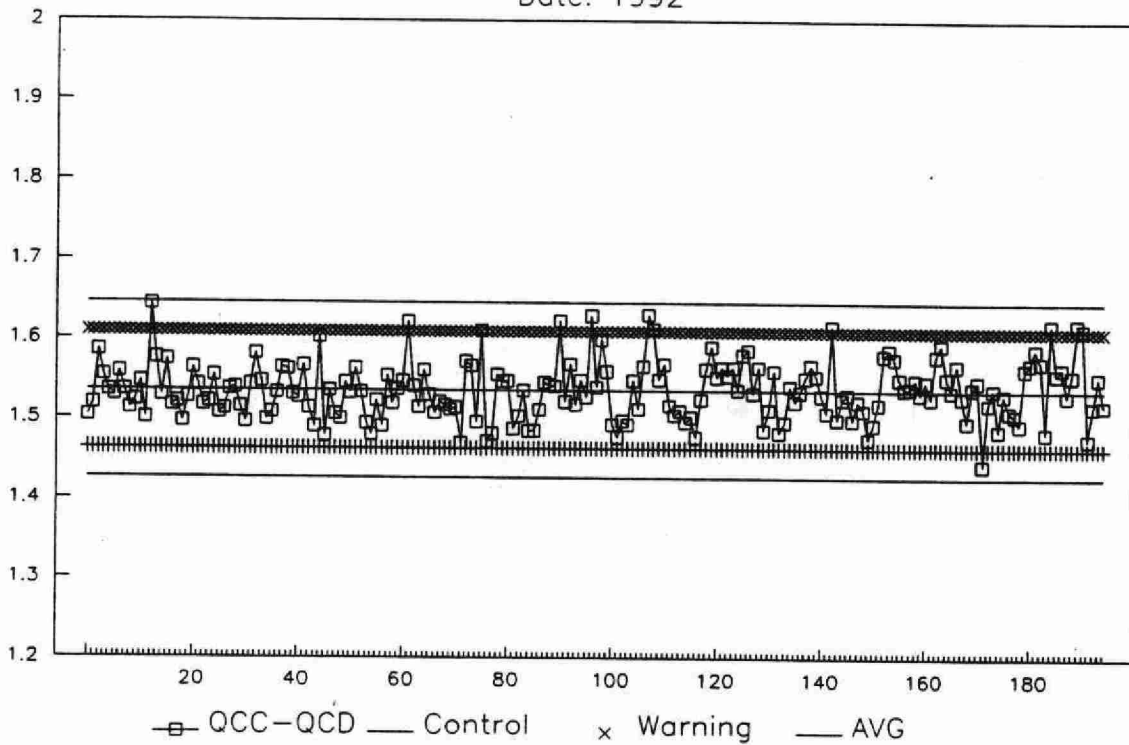
QC Sum Plot — Be

Date: 1992



QC Difference Plot — Be

Date: 1992



CADMIUM (TOTAL) – CDUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.2 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	1.000	0.988	98.8	2.0
QCD:	195	0.200	0.199	99.5	3.5
QCC+QCD:	195	1.200	1.187	98.9	2.0
QCC–QCD:	195	0.800	0.789	98.6	2.3

For 1993 Control Limits:

$$Sw (C-D) = 0.0179$$

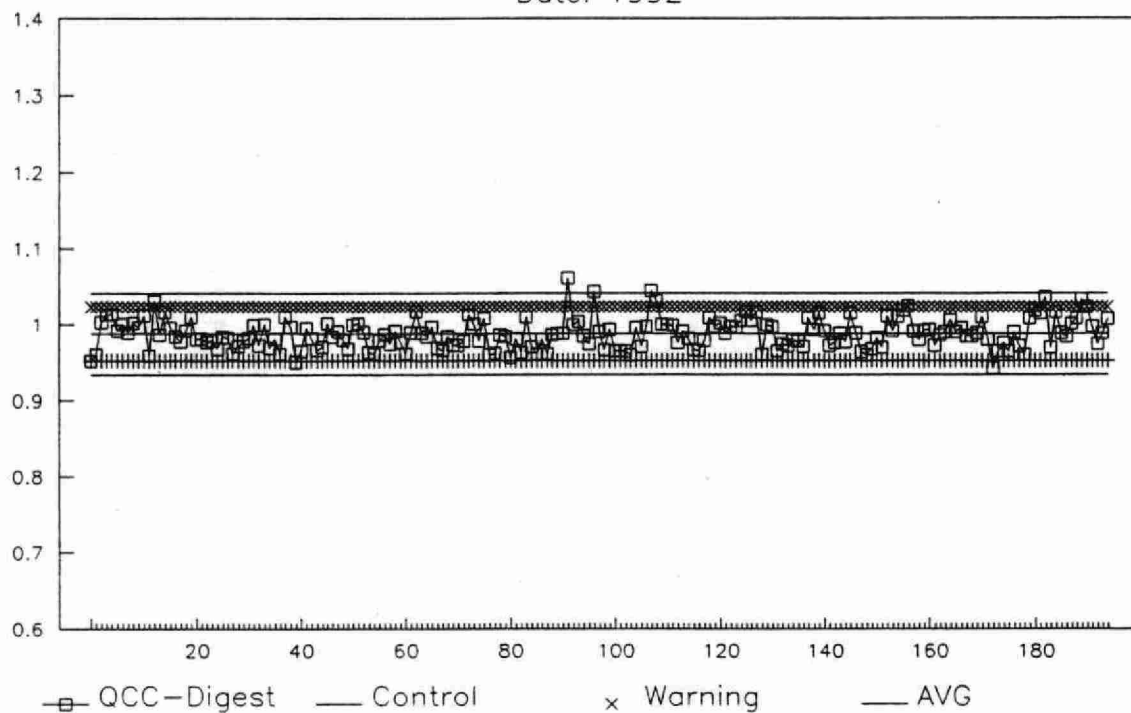
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
154	0.2	20	0.26	0.0700
0	20	200	–	–
0	200	2000	–	–

$$\text{Detection Limit (DL)} = \boxed{0.2 \text{ ug/L}}$$

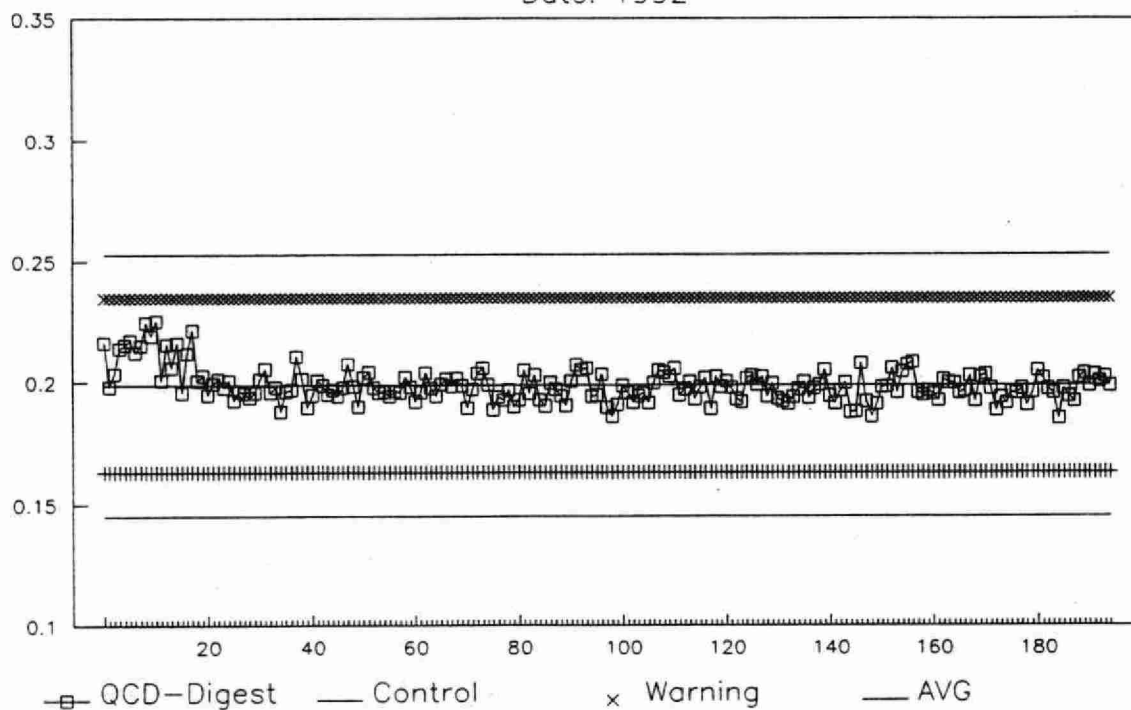
QCC Data — Cd

Date: 1992



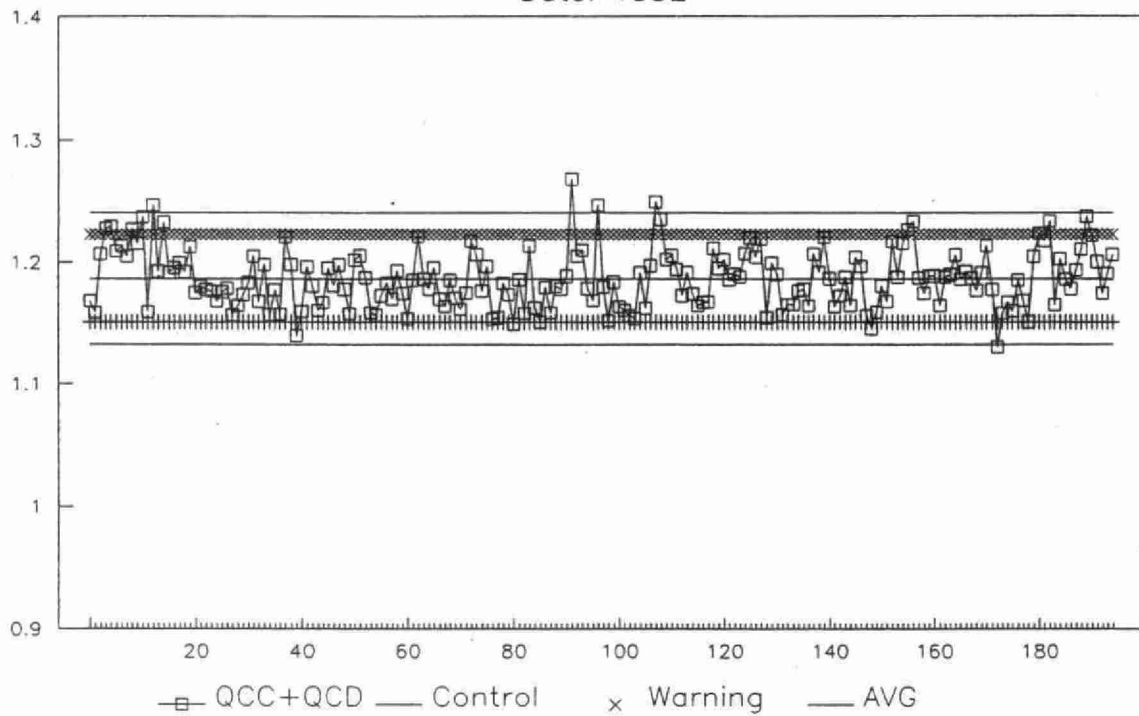
QCD Data — Cd

Date: 1992



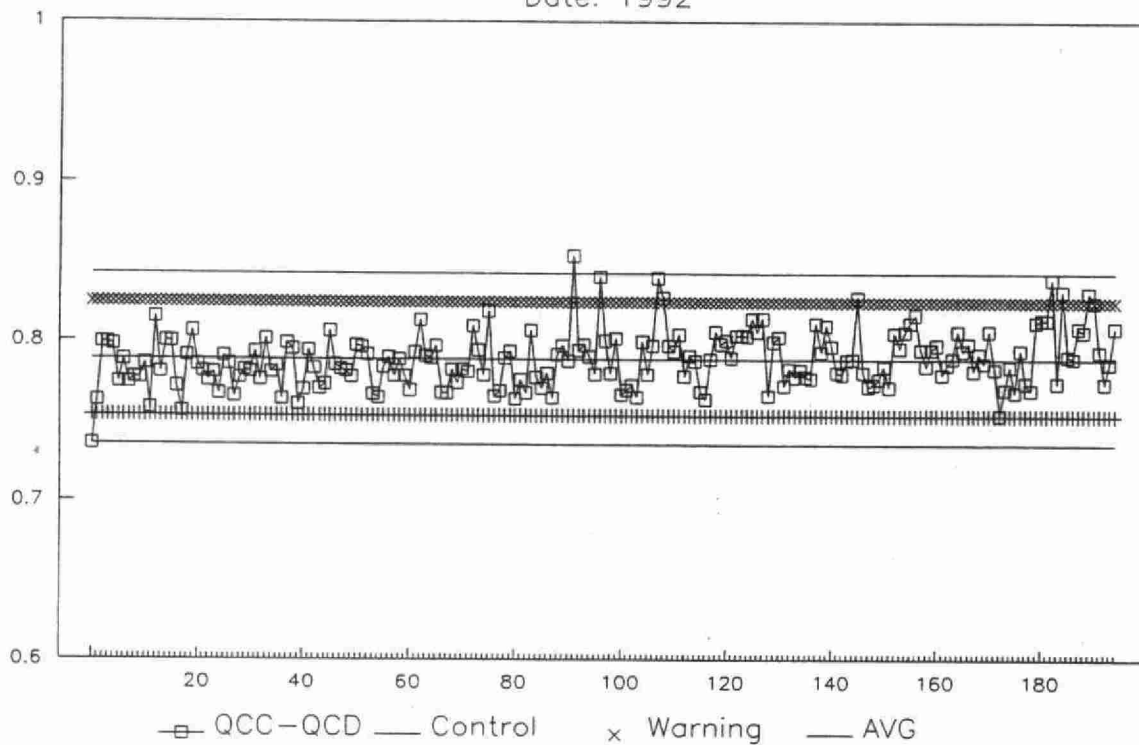
QC Sum Plot — Cd

Date: 1992



QC Difference Plot — Cd

Date: 1992



COBALT (TOTAL) – COUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	194	2.000	1.982	99.1	2.0
QCD:	194	0.400	0.402	100.5	2.5
QCC+QCD:	194	2.400	2.384	99.3	1.9
QCC–QCD:	194	1.600	1.580	98.7	2.2

For 1993 Control Limits:

$$Sw (C-D) = 0.0354$$

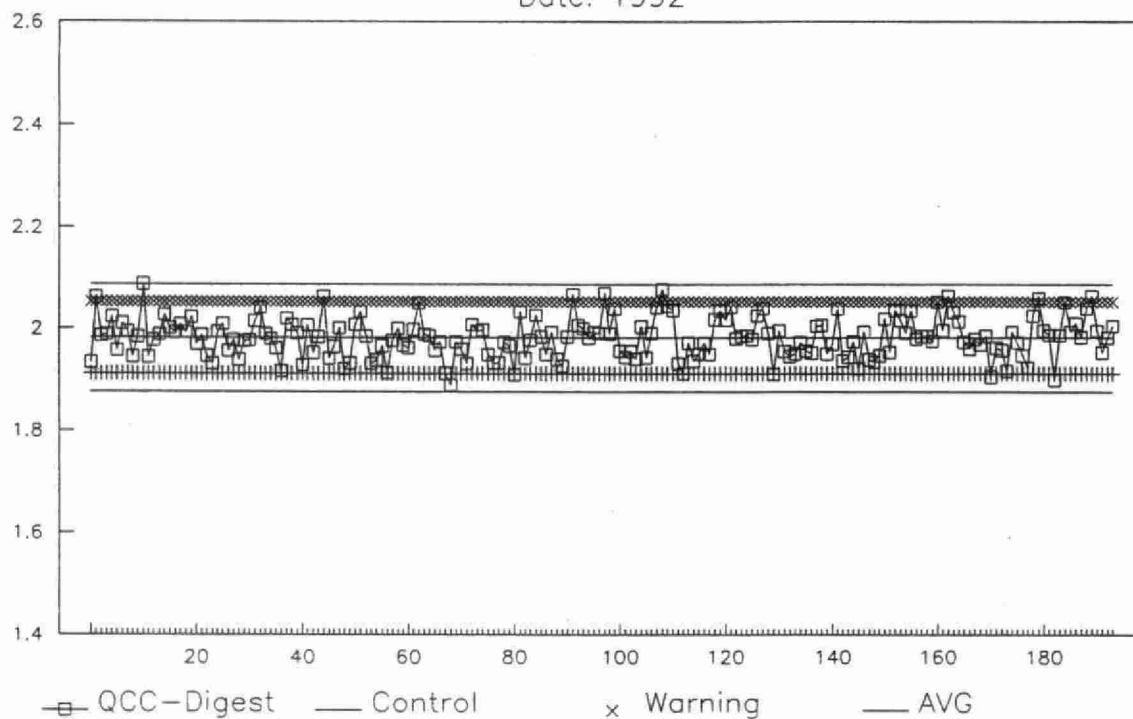
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
153	1	100	0.69	0.1690
N/A	100	1000	–	–
N/A	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

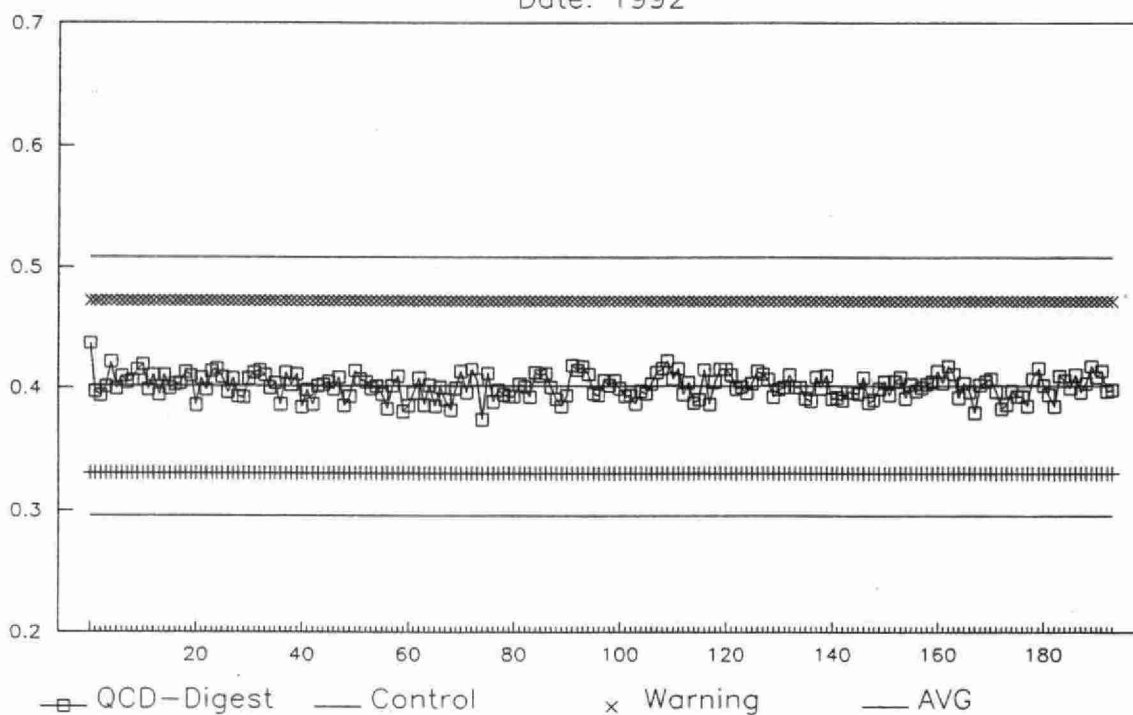
QCC Data — Co

Date: 1992



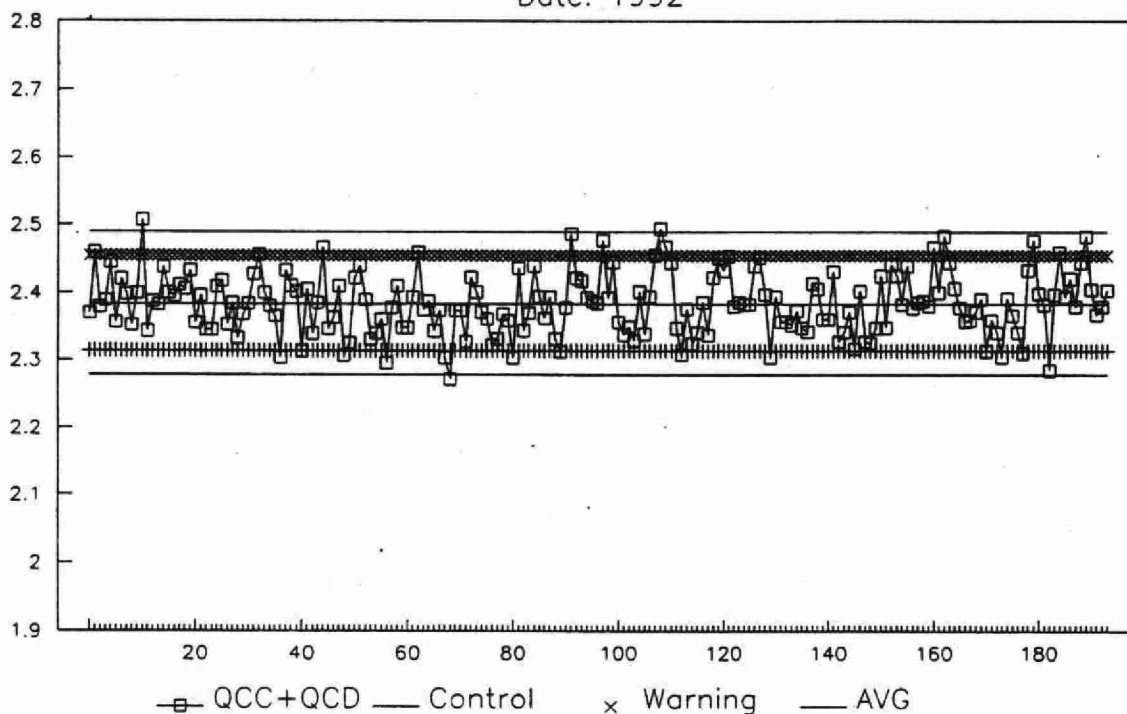
QCD Data — Co

Date: 1992



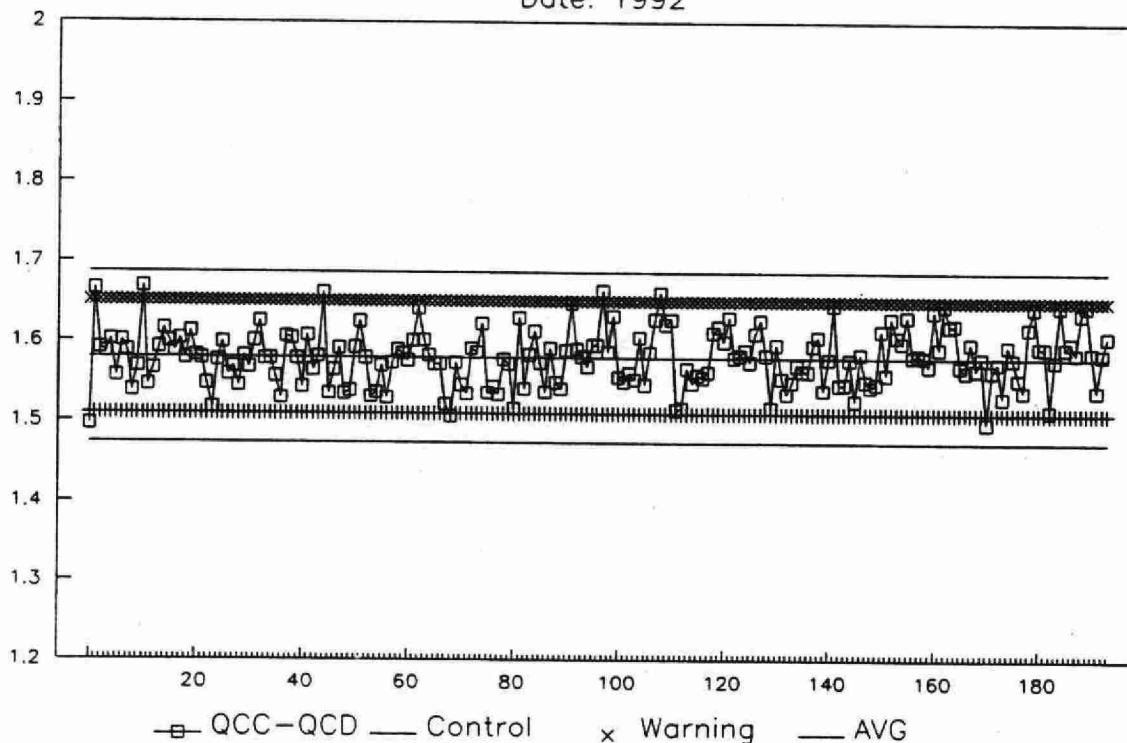
QC Sum Plot — Co

Date: 1992



QC Difference Plot — Co

Date: 1992



CHROMIUM (TOTAL) – CRUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	2.000	1.905	95.2	2.2
QCD:	195	0.400	0.384	96.0	3.4
QCC+QCD:	195	2.400	2.289	95.4	2.0
QCC–QCD:	195	1.600	1.521	95.1	2.5

For 1993 Control Limits:

$$Sw (C-D) = 0.0384$$

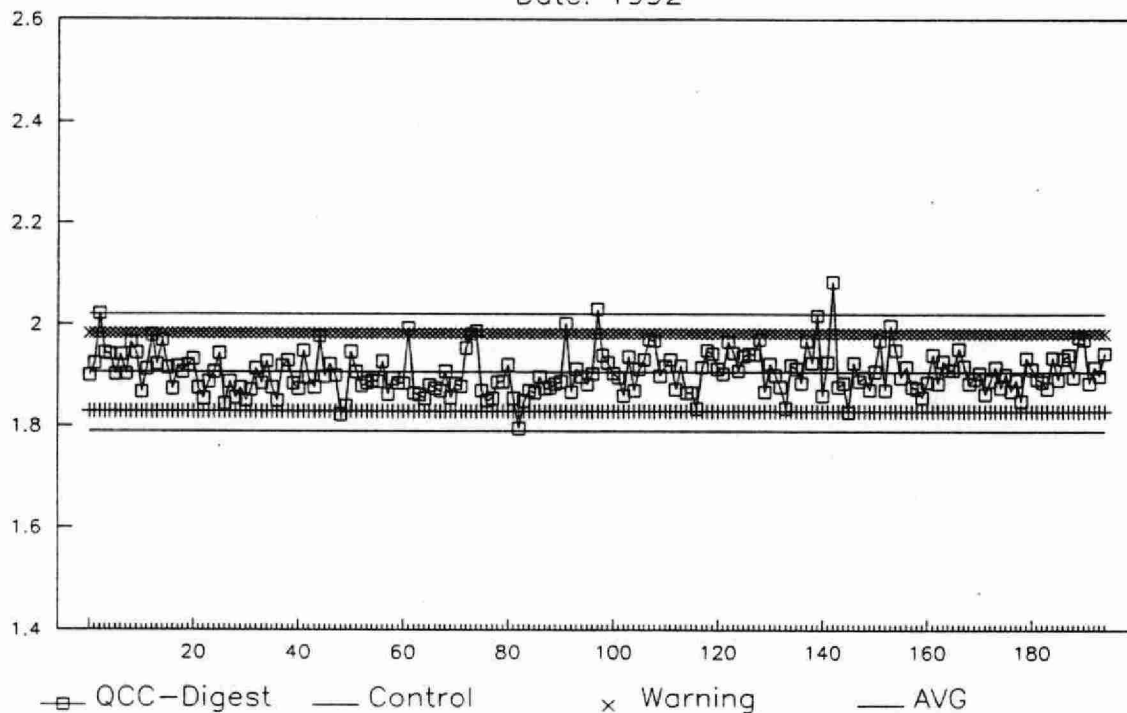
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
150	1	100	0.87	0.2135
0	100	1000	–	–
0	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

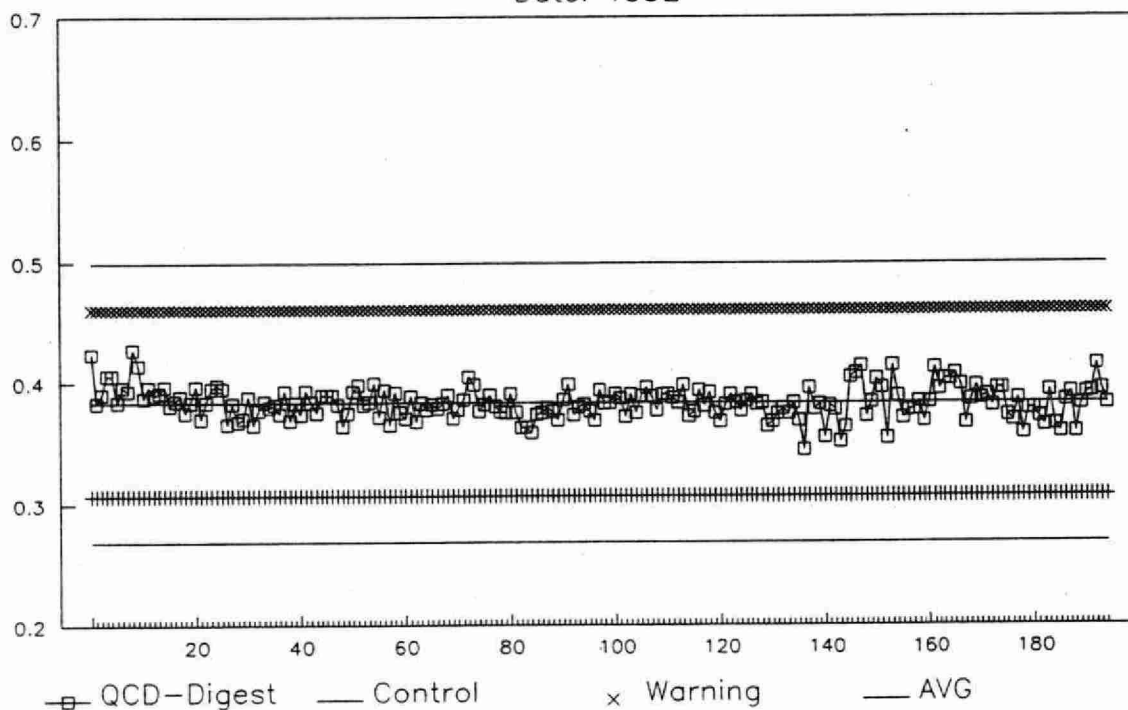
QCC Data — Cr

Date: 1992



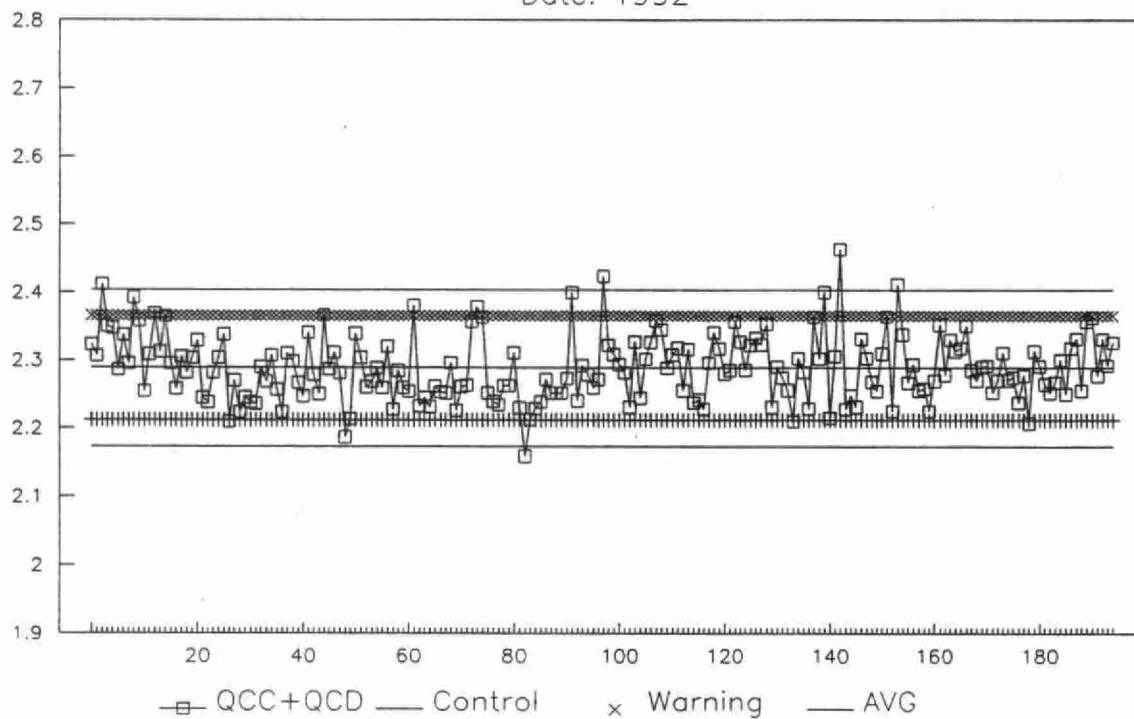
QCD Data — Cr

Date: 1992



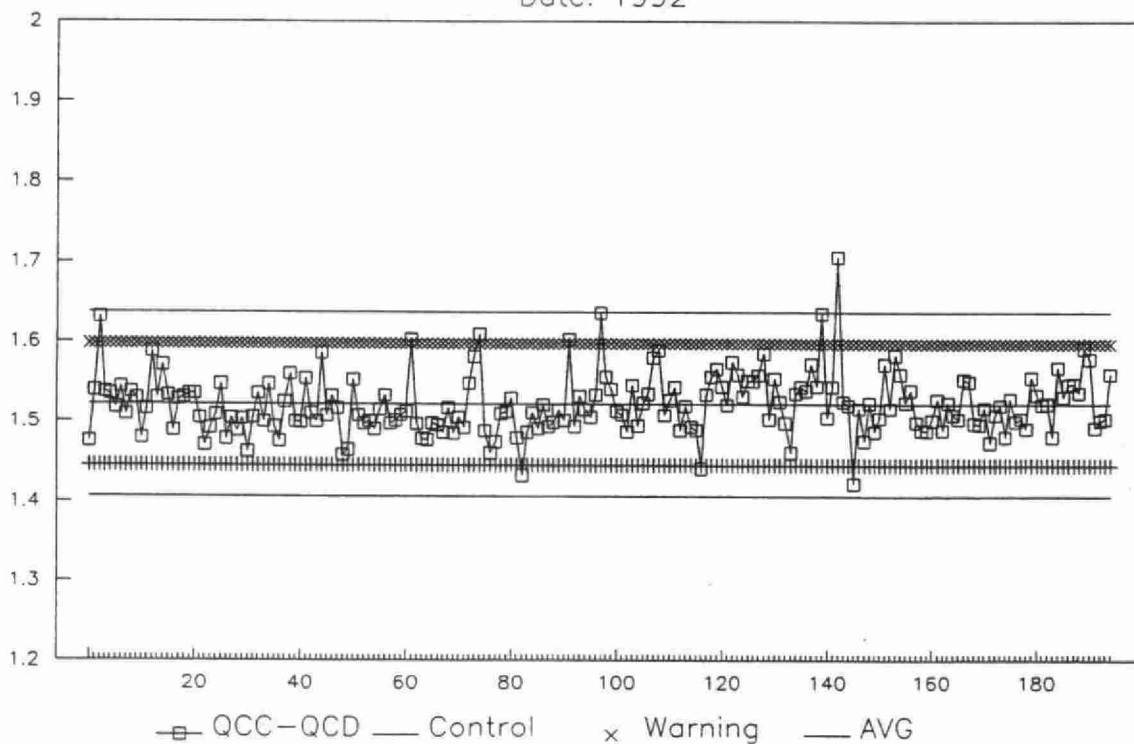
QC Sum Plot — Cr

Date: 1992



QC Difference Plot — Cr

Date: 1992



COPPER (TOTAL) – CUUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.5 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	194	2.000	1.928	96.4	2.1
QCD:	194	0.400	0.393	98.2	2.6
QCC + QCD:	194	2.400	2.321	96.7	2.0
QCC – QCD:	194	1.600	1.535	95.9	2.3

For 1993 Control Limits:

$$Sw (C-D) = 0.0356$$

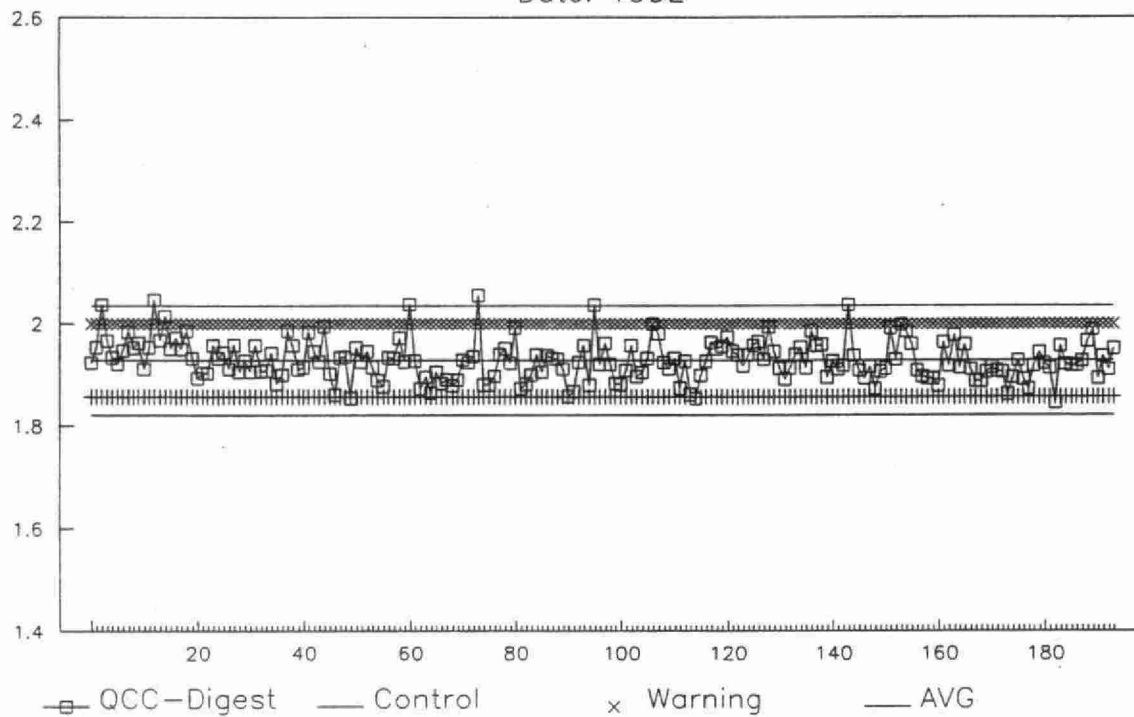
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
132	0.5	50	4.78	0.5140
11	50	500	183.3	3.67
6	500	5000	1143	24

$$\text{Detection Limit (DL)} = \boxed{0.5 \text{ ug/L}}$$

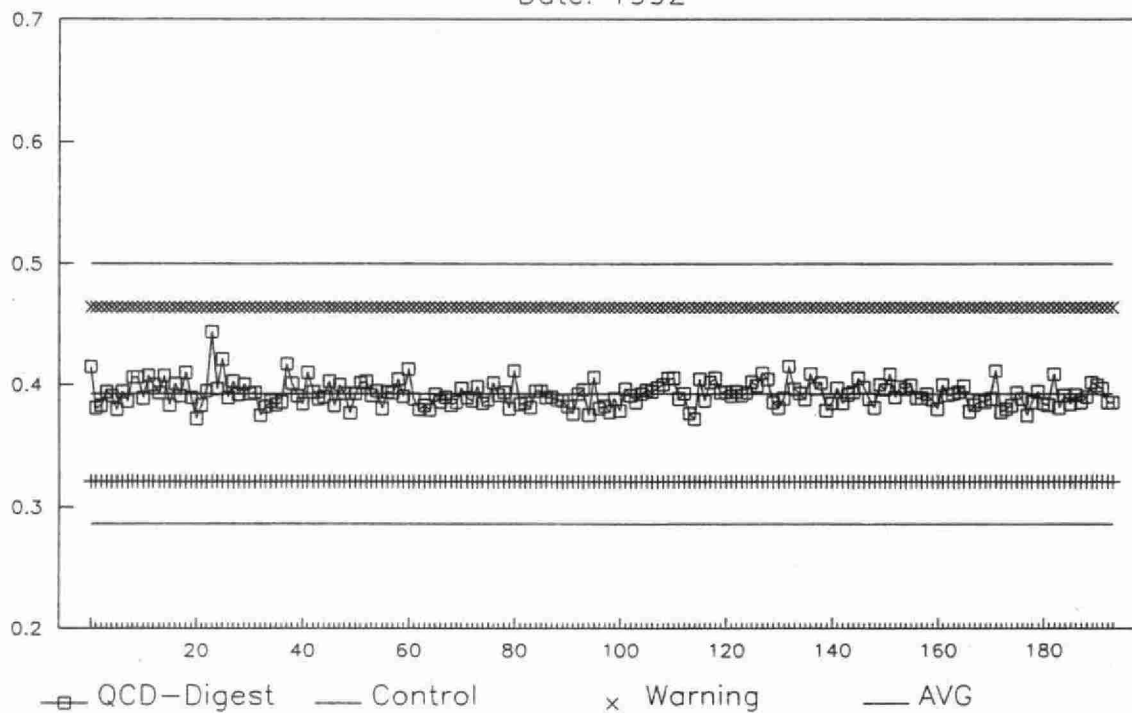
QCC Data — Cu

Date: 1992



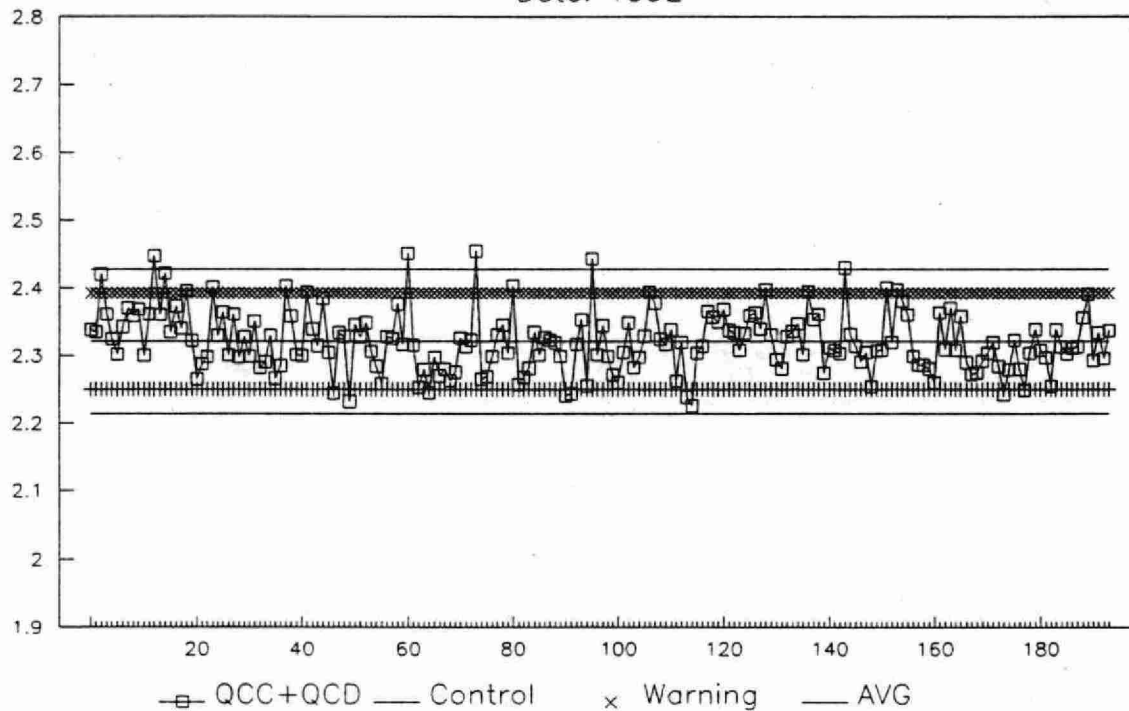
QCD Data — Cu

Date: 1992



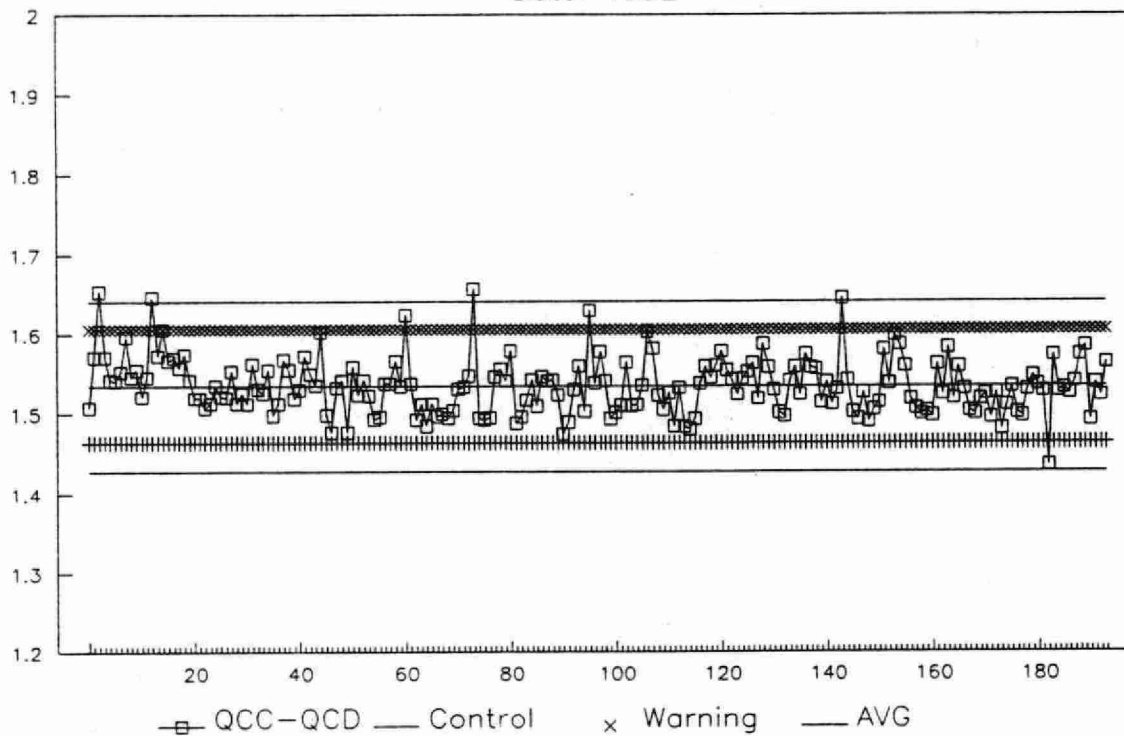
QC Sum Plot — Cu

Date: 1992



QC Difference Plot — Cu

Date: 1992



IRON (TOTAL) – FEUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 5 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	186	10.000	9.896	99.0	2.5
QCD:	186	2.000	2.002	100.1	5.5
QCC+QCD:	186	12.000	11.907	99.2	2.6
QCC–QCD:	186	8.000	7.884	98.5	2.7

For 1993 Control Limits:

$$Sw (C-D) = 0.2127$$

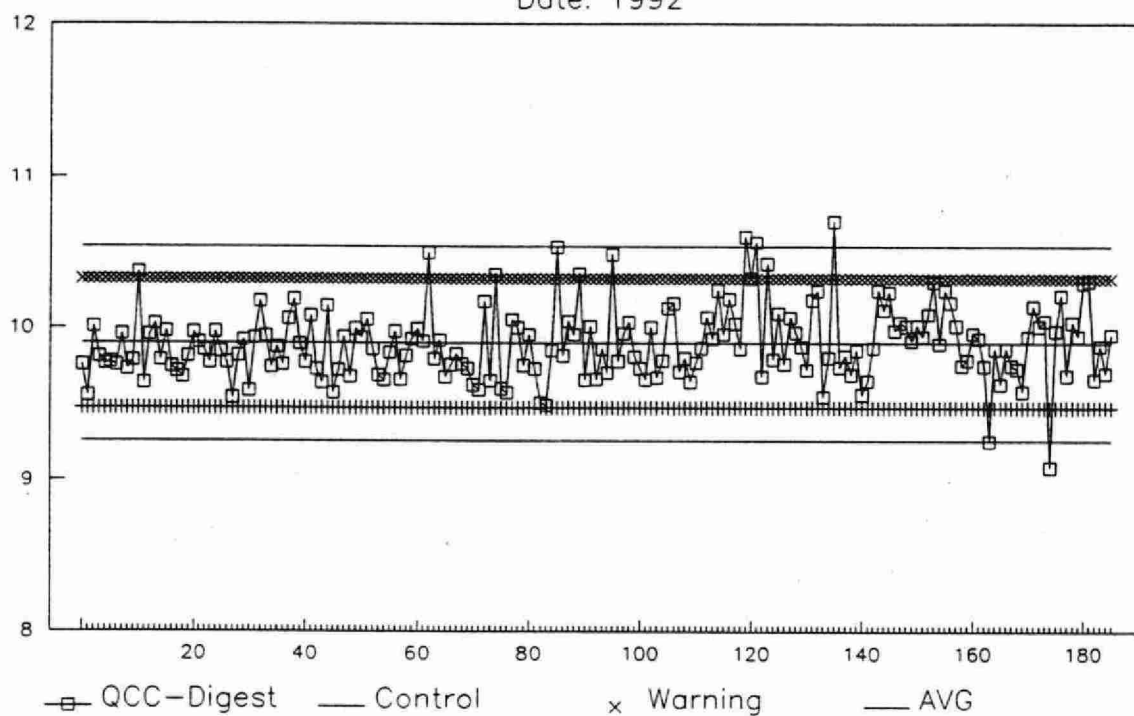
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
114	5	500	152	7.37
29	500	5000	1296	101.0
5	5000	50000	6850	183

Detection Limit (DL) = 5 ug/L

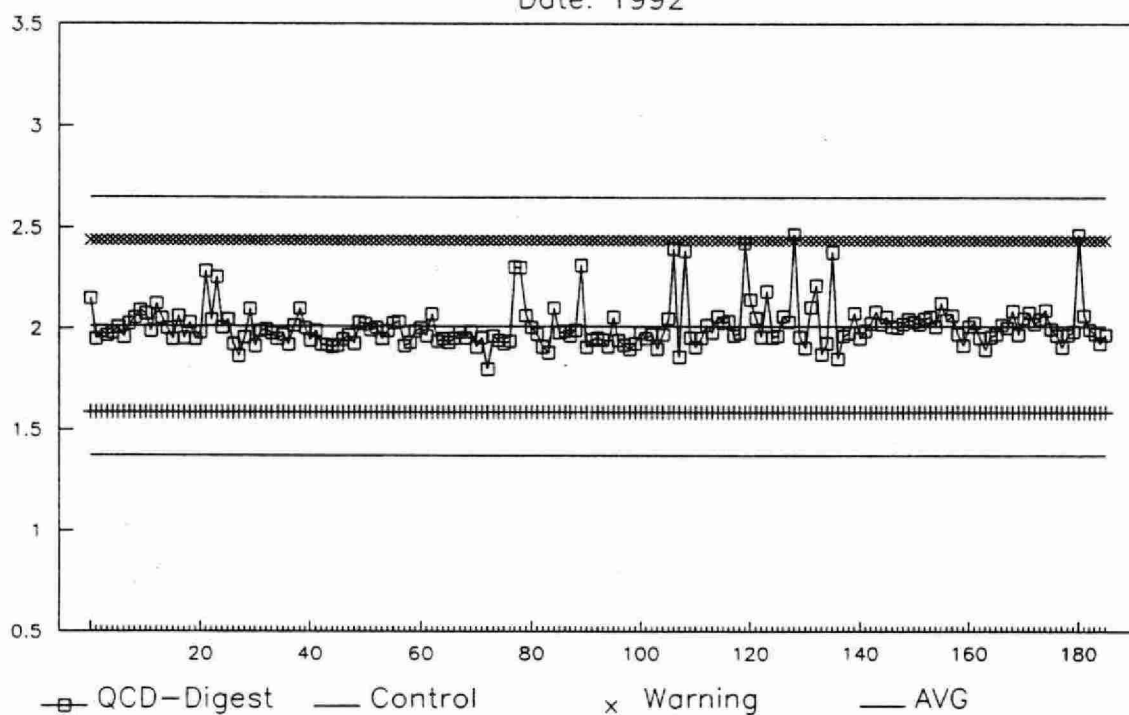
QCC Data — Fe

Date: 1992



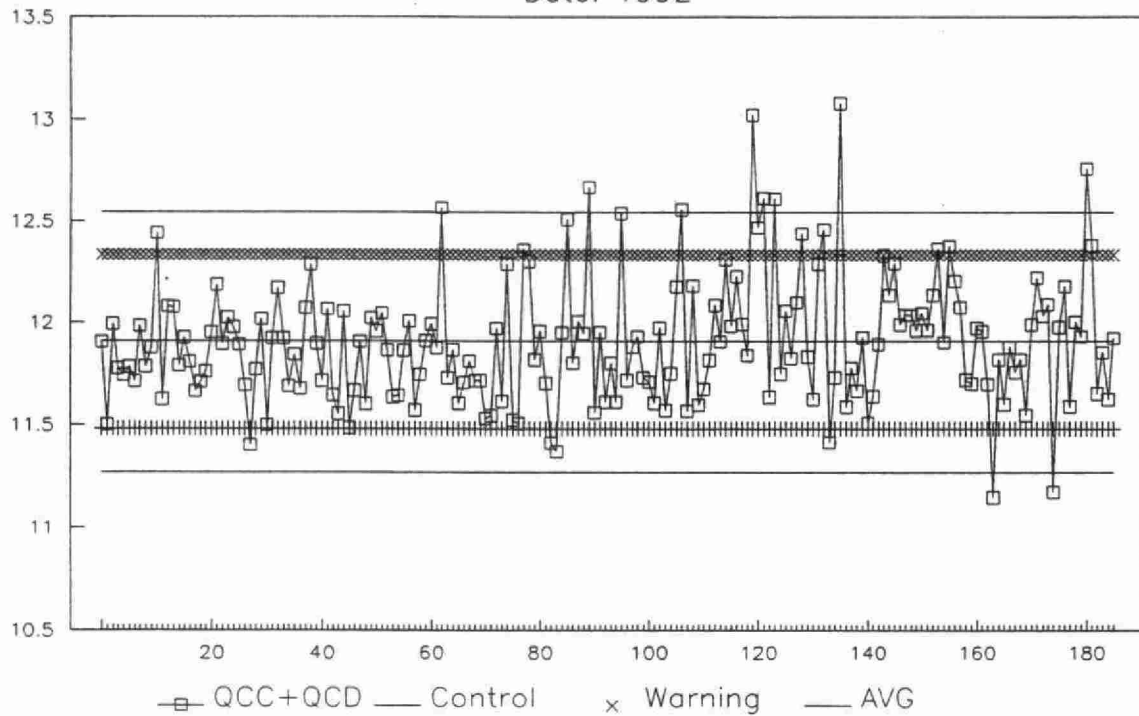
QCD Data — Fe

Date: 1992



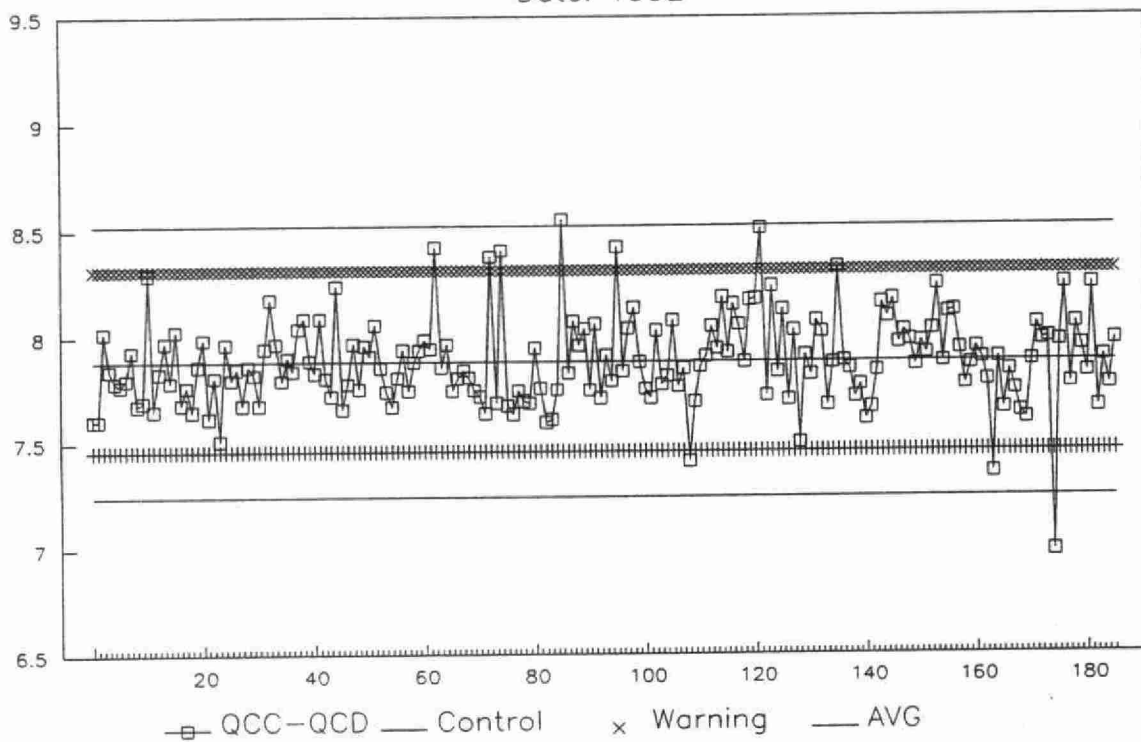
QC Sum Plot — Fe

Date: 1992



QC Difference Plot — Fe

Date: 1992



LEAD (TOTAL) – PBUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 2 – 20,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	194	2.000	1.949	97.4	2.7
QCD:	194	0.400	0.396	99.0	9.1
QCC+QCD:	194	2.400	2.345	97.7	3.3
QCC–QCD:	194	1.600	1.553	97.1	3.1

For 1993 Control Limits:

$$Sw (C-D) = 0.0483$$

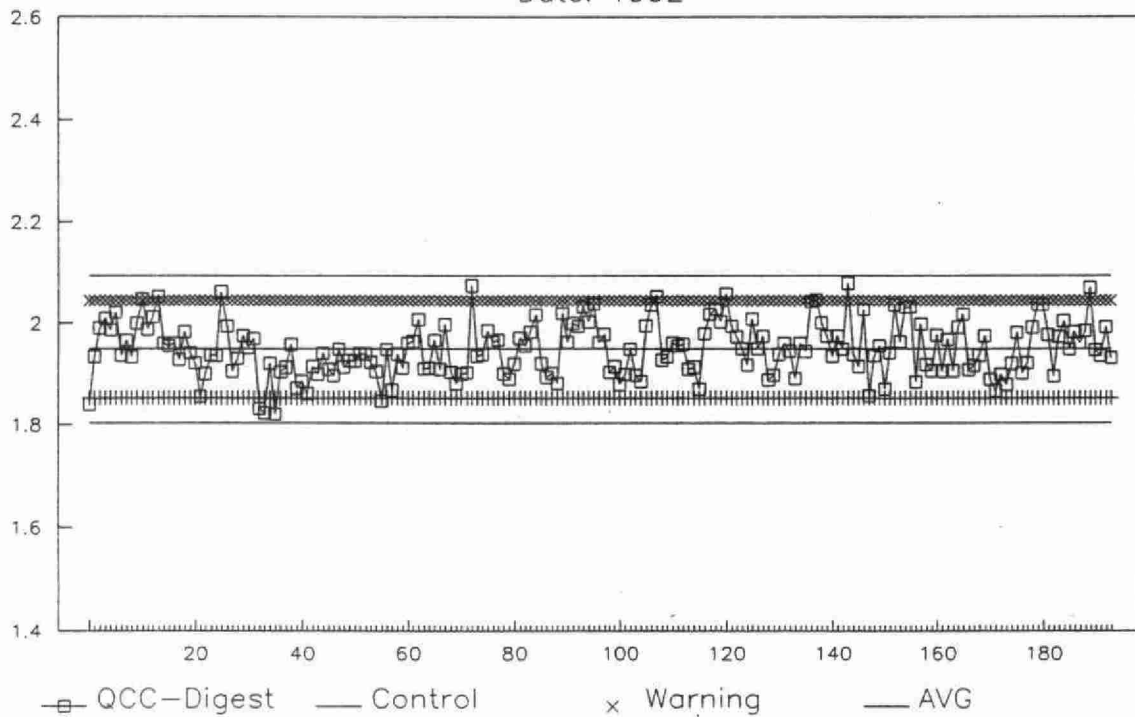
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
145	2	200	2.66	0.8986
0	200	2000	–	–
0	2000	20000	–	–

Detection Limit (DL) = 2 ug/L

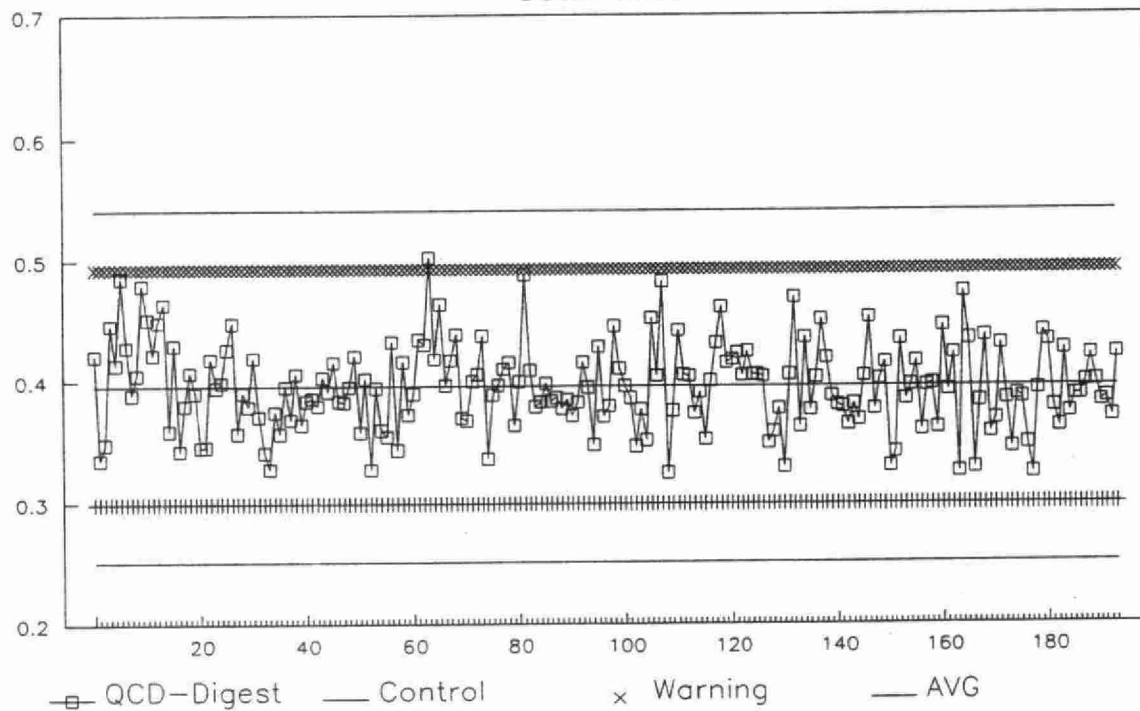
QCC Data — Pb

Date: 1992



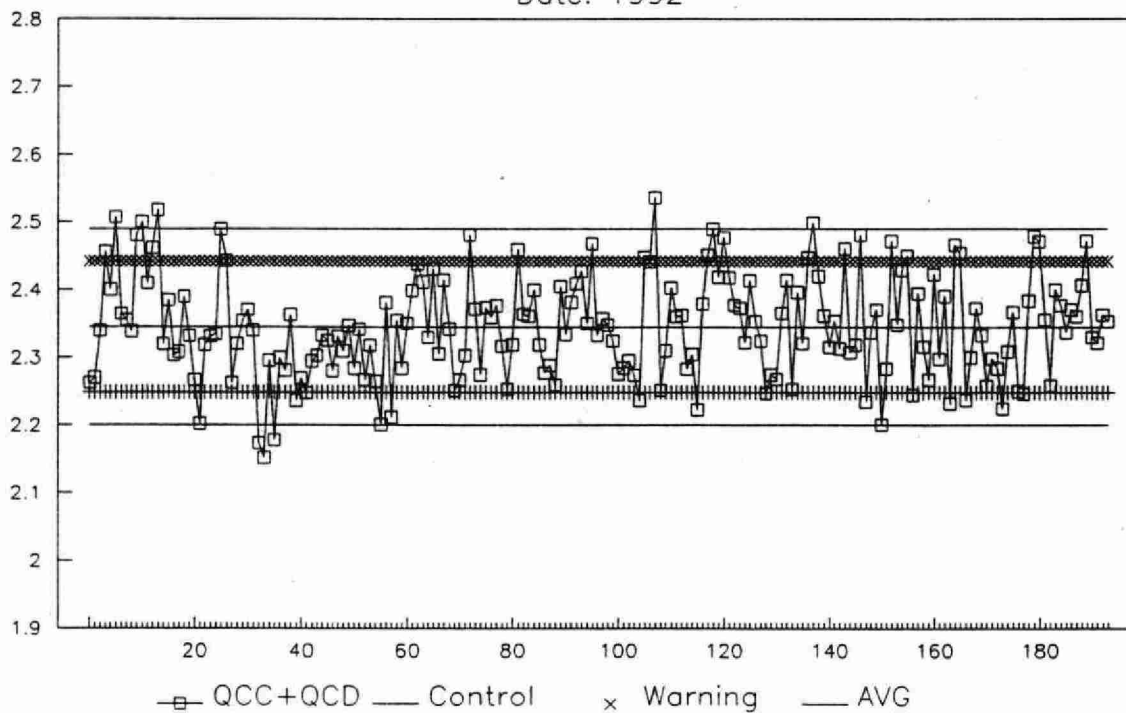
QCD Data — Pb

Date: 1992



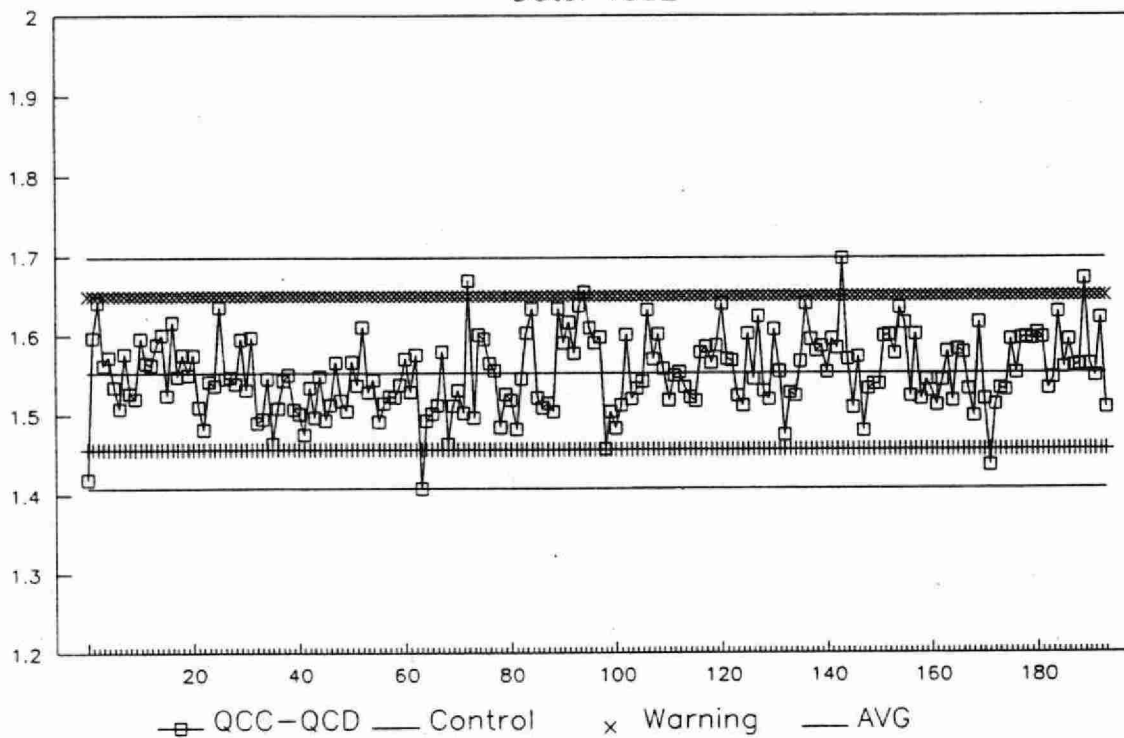
QC Sum Plot — Pb

Date: 1992



QC Difference Plot — Pb

Date: 1992



MANGANESE (TOTAL) – MNUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	2.000	1.963	98.2	2.1
QCD:	195	0.400	0.397	99.3	2.2
QCC+QCD:	195	2.400	2.360	98.3	2.0
QCC–QCD:	195	1.600	1.566	97.9	2.2

For 1993 Control Limits:

$$Sw (C-D) = 0.0352$$

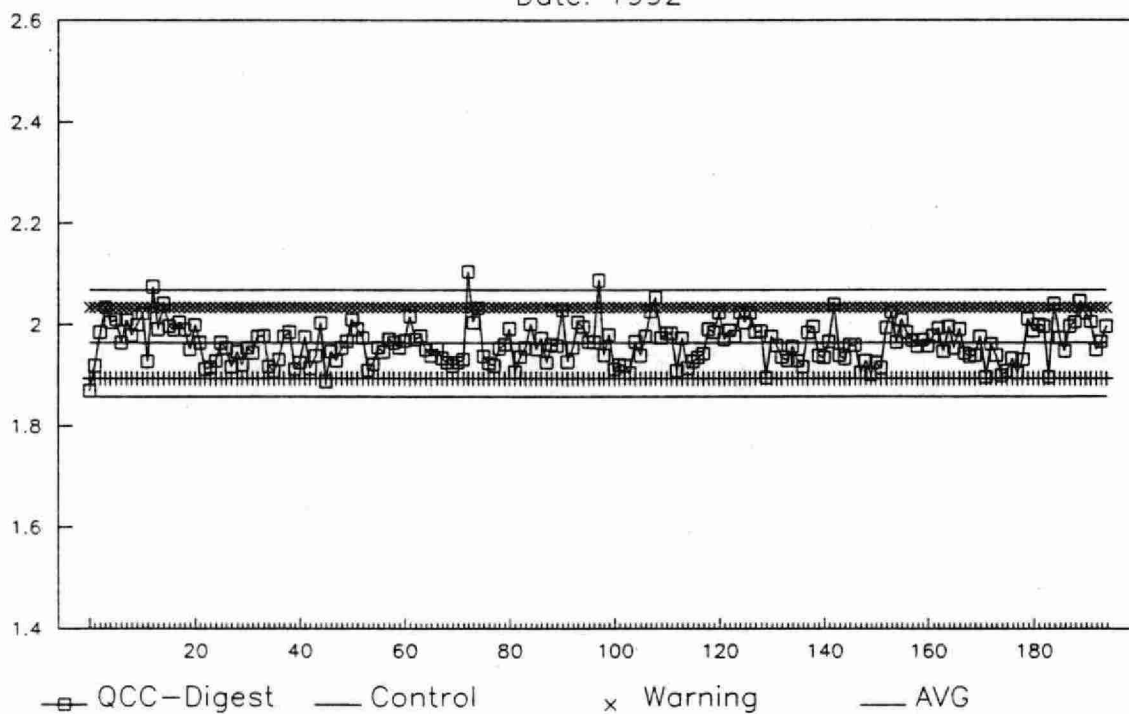
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
134	1	100	22.48	0.6940
16	100	1000	188.0	3.61
0	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

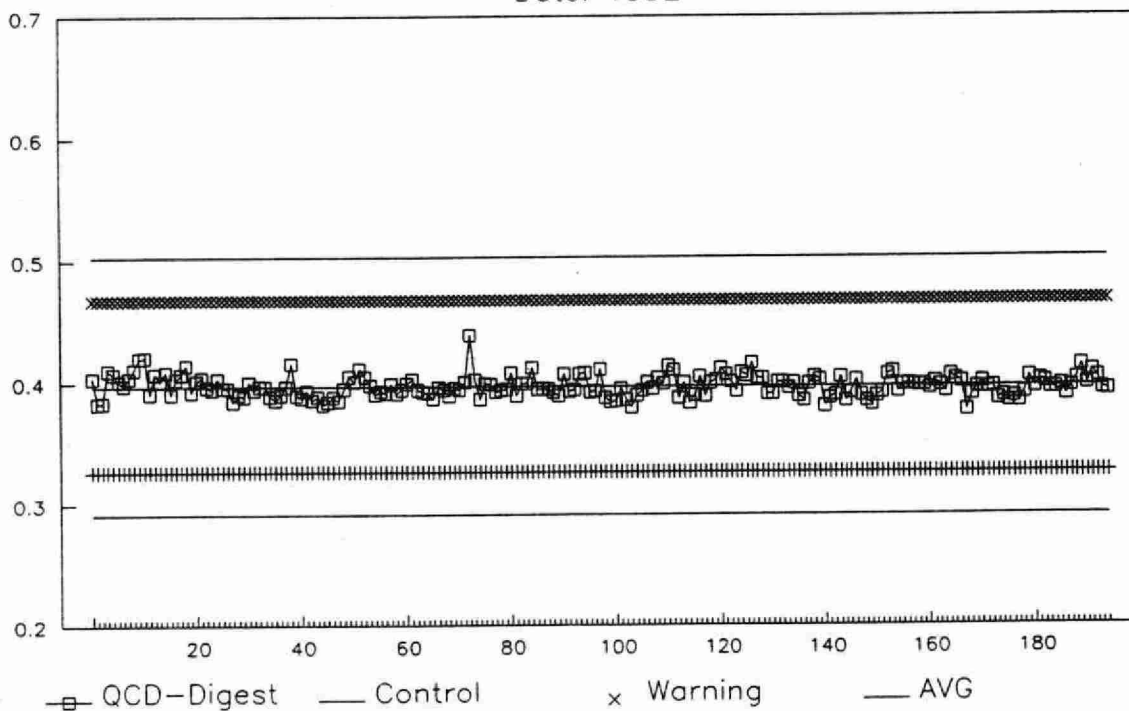
QCC Data — Mn

Date: 1992



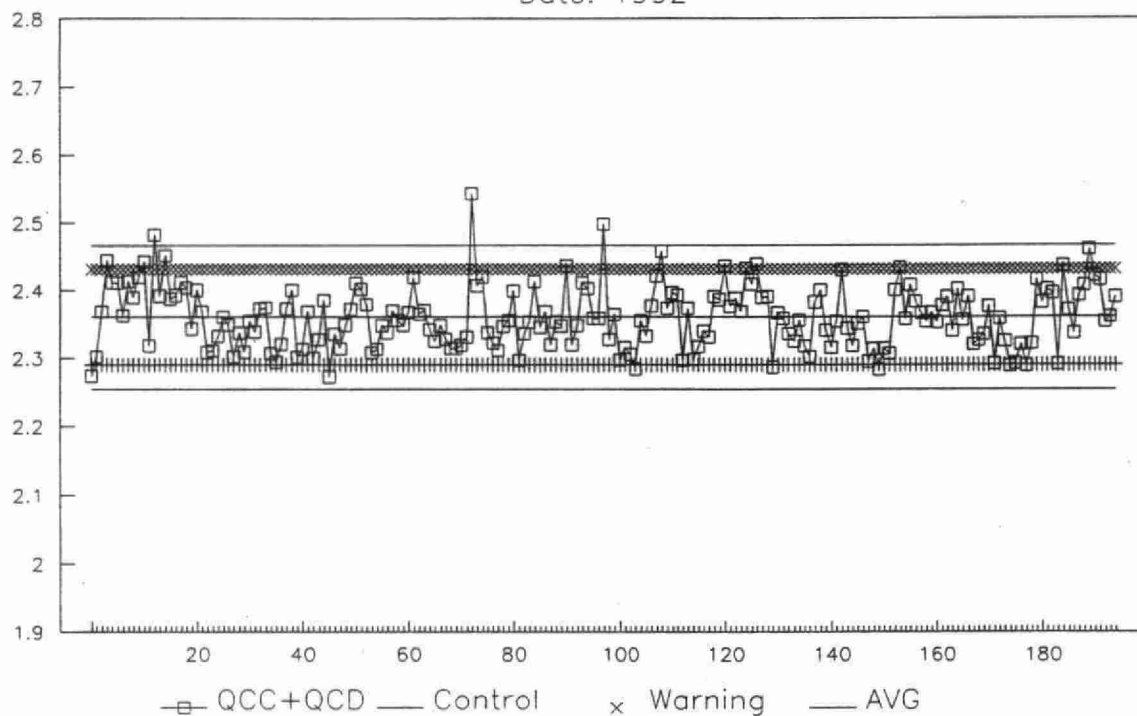
QCD Data — Mn

Date: 1992

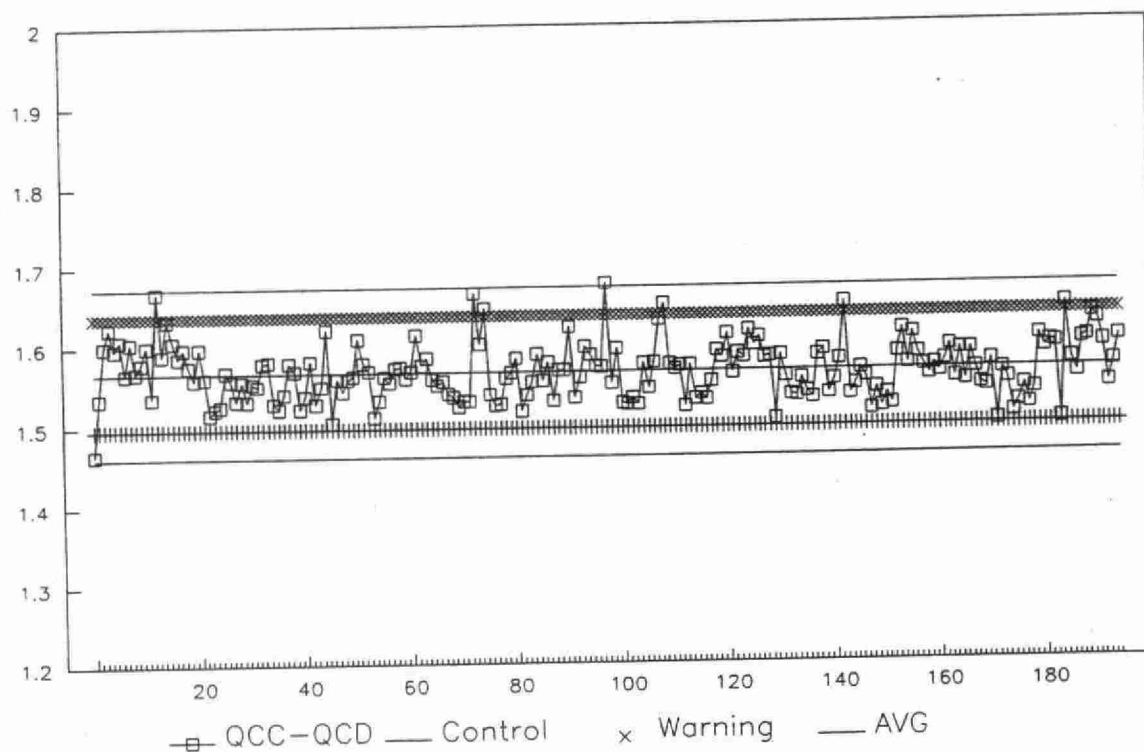


QC Sum Plot — Mn

Date: 1992



QC Difference Plot — Mn



MOLYBDENUM (TOTAL) – MOUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.5 – 20,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	2.000	1.944	97.2	3.0
QCD:	195	0.400	0.390	97.6	2.9
QCC+QCD:	195	2.400	2.334	97.3	2.8
QCC–QCD:	195	1.600	1.554	97.1	3.5

For 1993 Control Limits:

$$Sw (C-D) = 0.0537$$

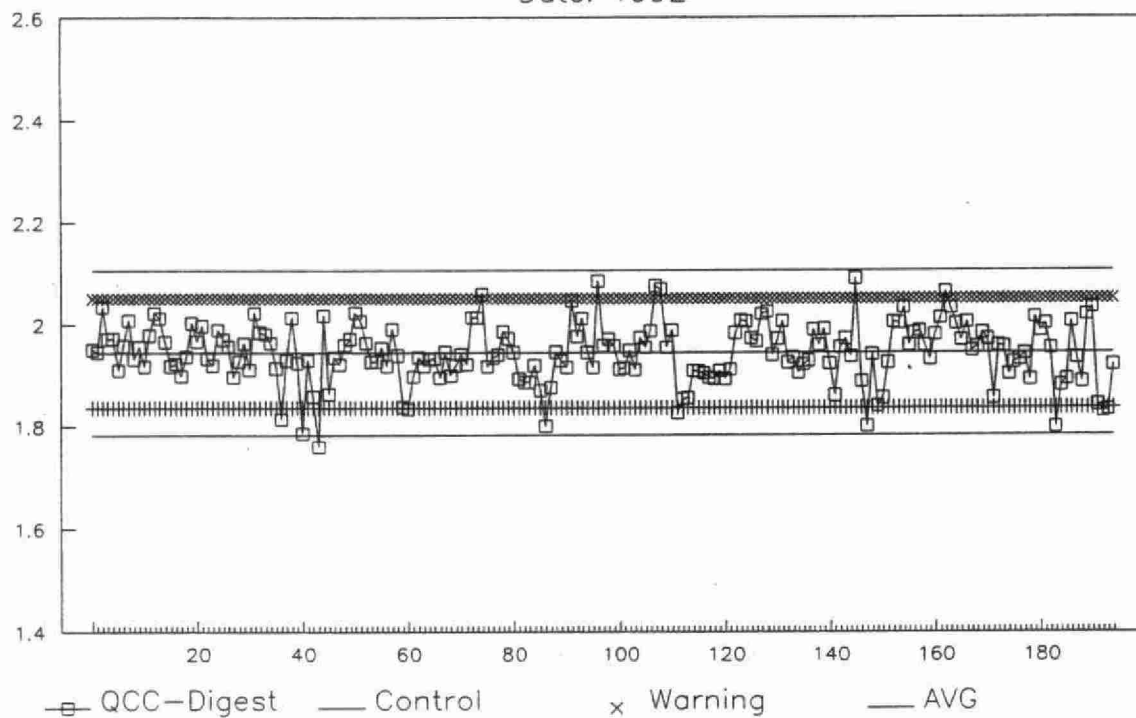
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
153	0.5	50	1.15	0.1344
0	50	500	–	–
0	500	5000	–	–

Detection Limit (DL) = 0.5 ug/L

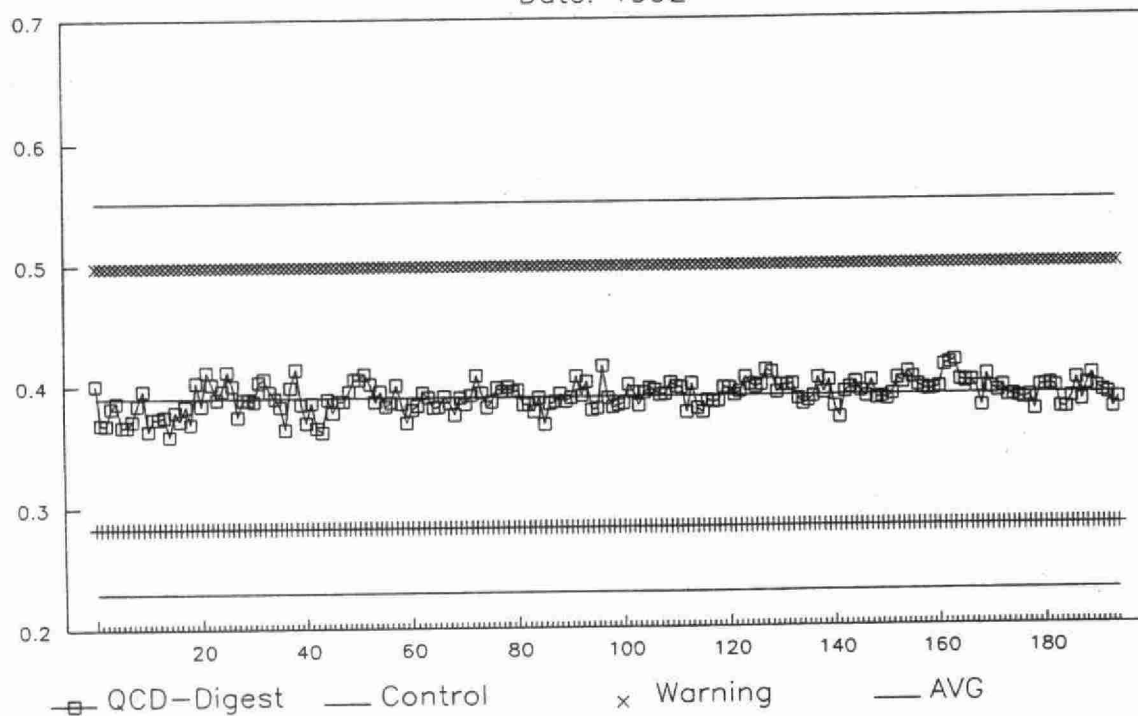
QCC Data — Mo

Date: 1992



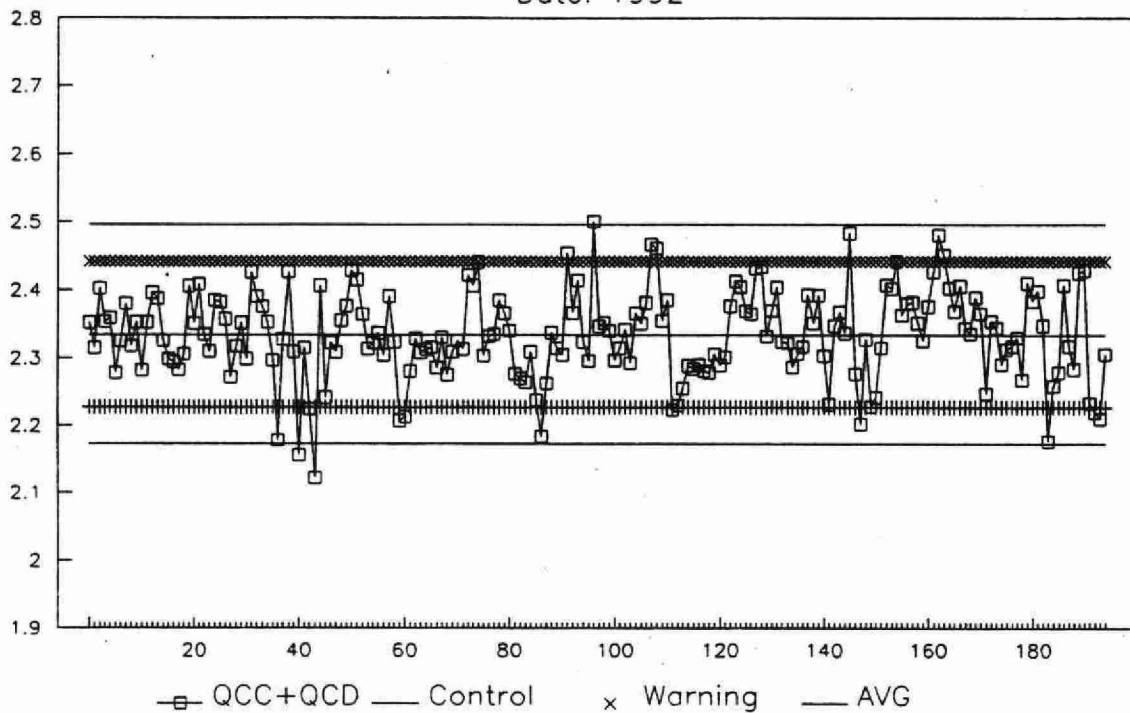
QCD Data — Mo

Date: 1992



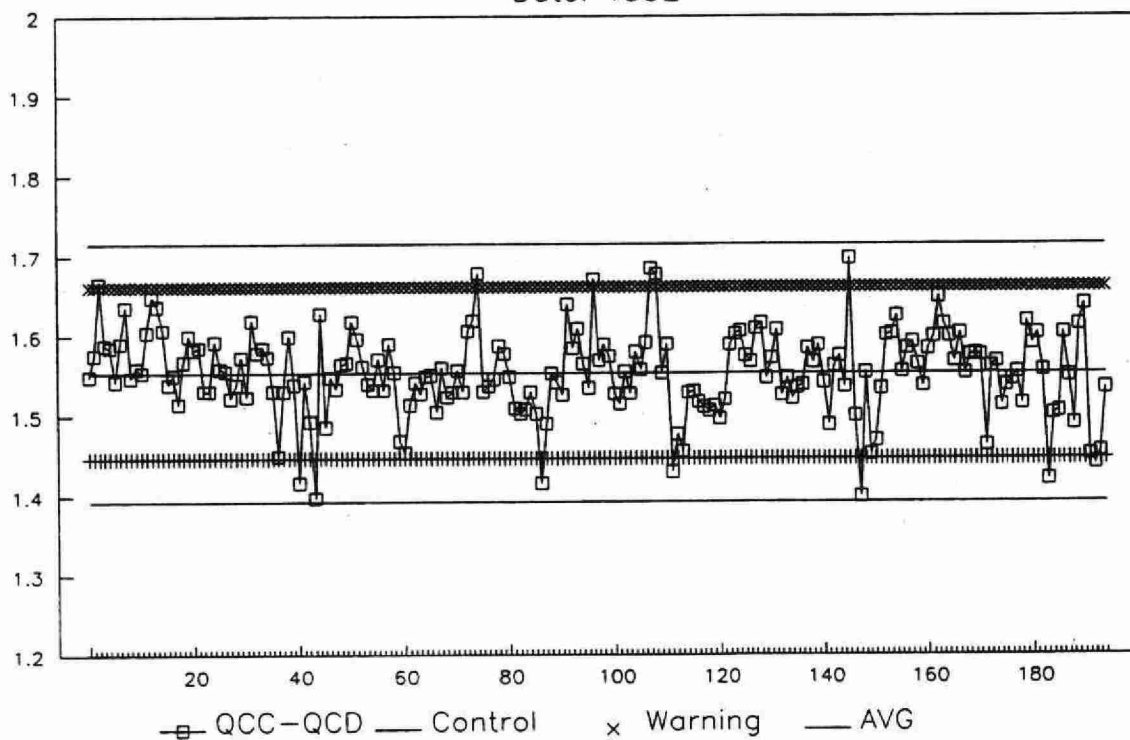
QC Sum Plot — Mo

Date: 1992



QC Difference Plot — Mo

Date: 1992



NICKEL (TOTAL) – NIUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 20,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	191	2.000	1.983	99.1	2.5
QCD:	191	0.400	0.403	100.8	3.8
QCC+QCD:	191	2.400	2.386	99.4	2.5
QCC–QCD:	191	1.600	1.579	98.7	2.7

For 1993 Control Limits:

$$Sw (C-D) = 0.0428$$

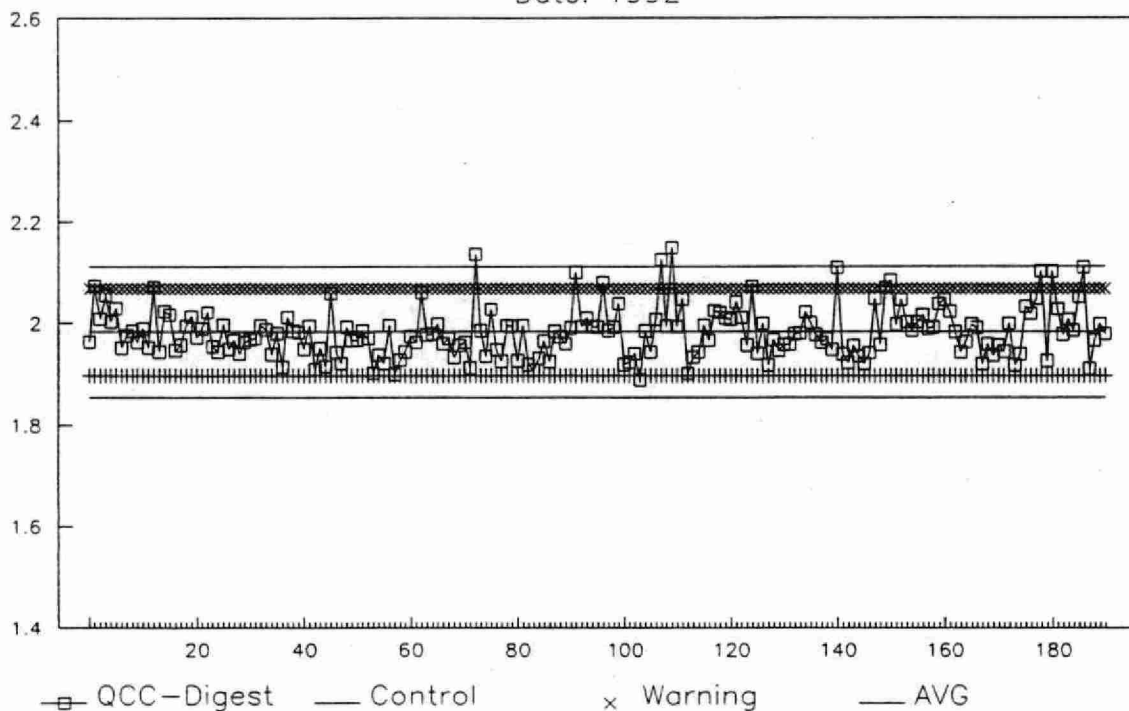
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
134	1	100	2.96	0.5812
0	100	1000	–	–
0	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

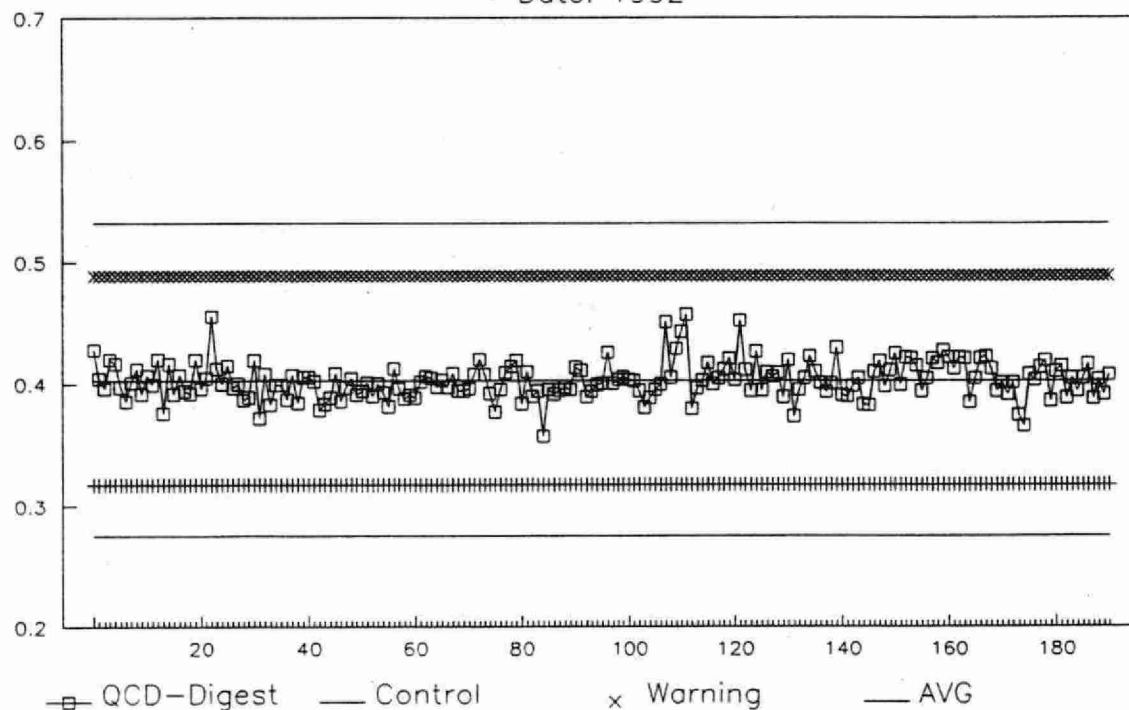
QCC Data — Ni

Date: 1992



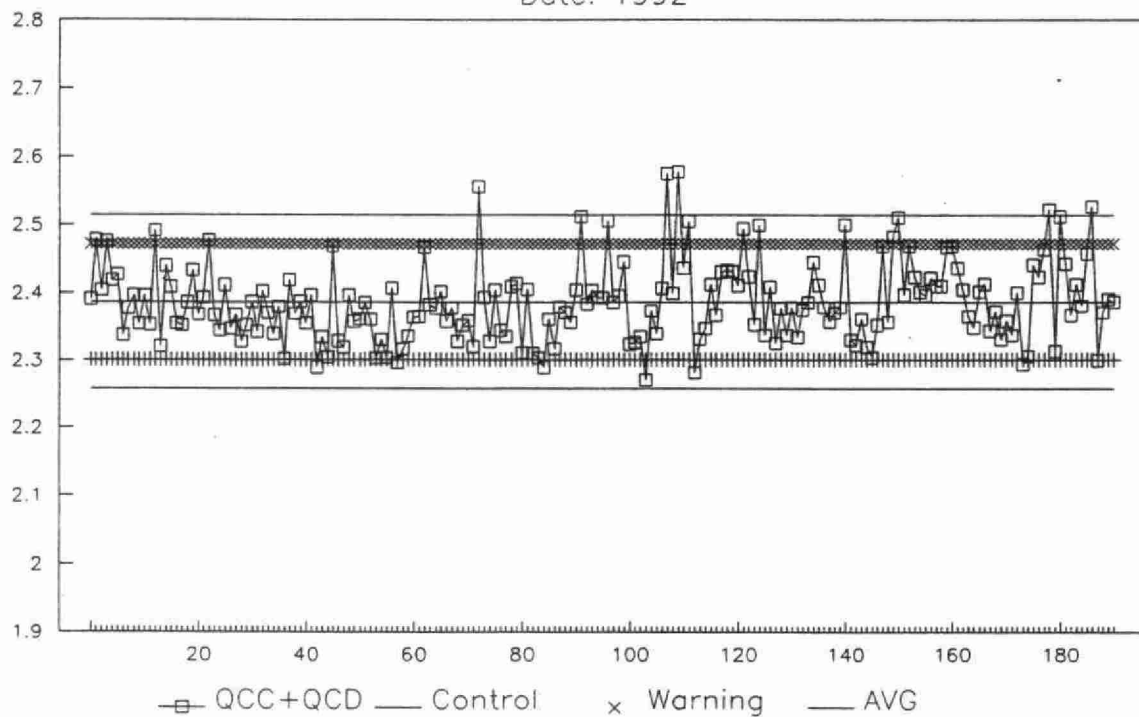
QCD Data — Ni

Date: 1992



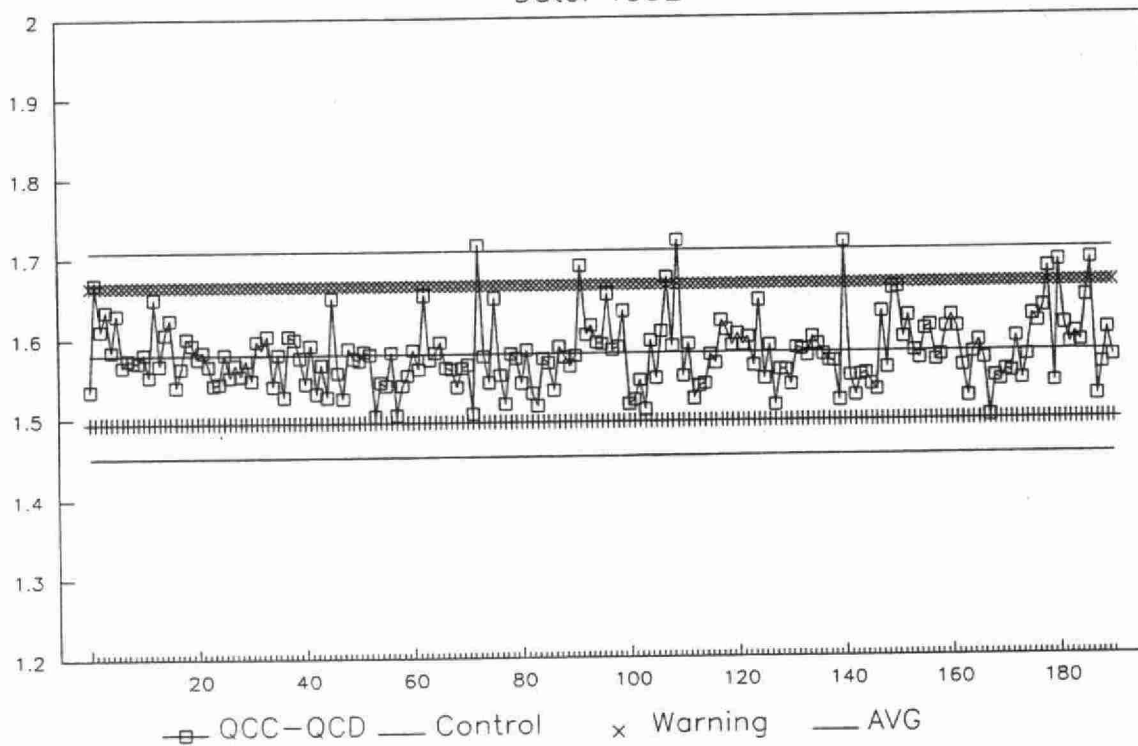
QC Sum Plot — Ni

Date: 1992



QC Difference Plot — NI

Date: 1992



STRONTIUM (TOTAL) – SRUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 10,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	1.000	0.979	97.9	2.3
QCD:	195	0.200	0.195	97.5	2.6
QCC + QCD:	195	1.200	1.174	97.8	2.2
QCC – QCD:	195	0.800	0.784	98.0	2.6

For 1993 Control Limits:

$$Sw (C-D) = 0.02$$

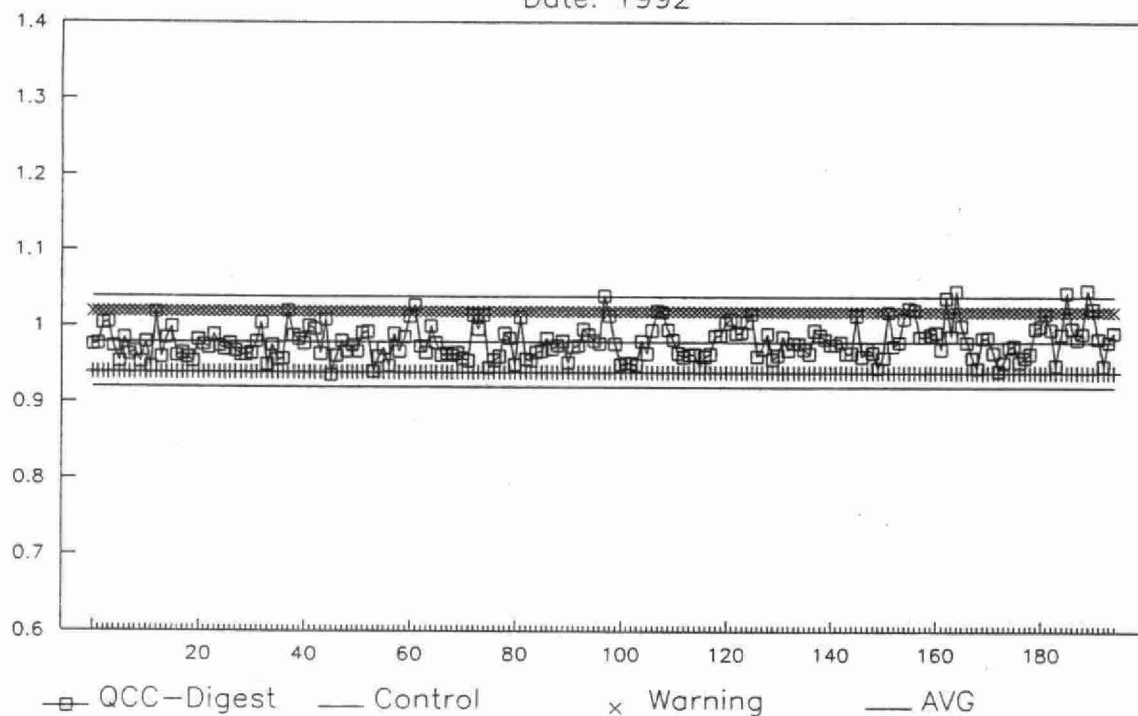
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
123	1	100	36.39	1.7965
25	100	1000	250.4	3.98
0	1000	10000	—	—

Detection Limit (DL) = 1 ug/L

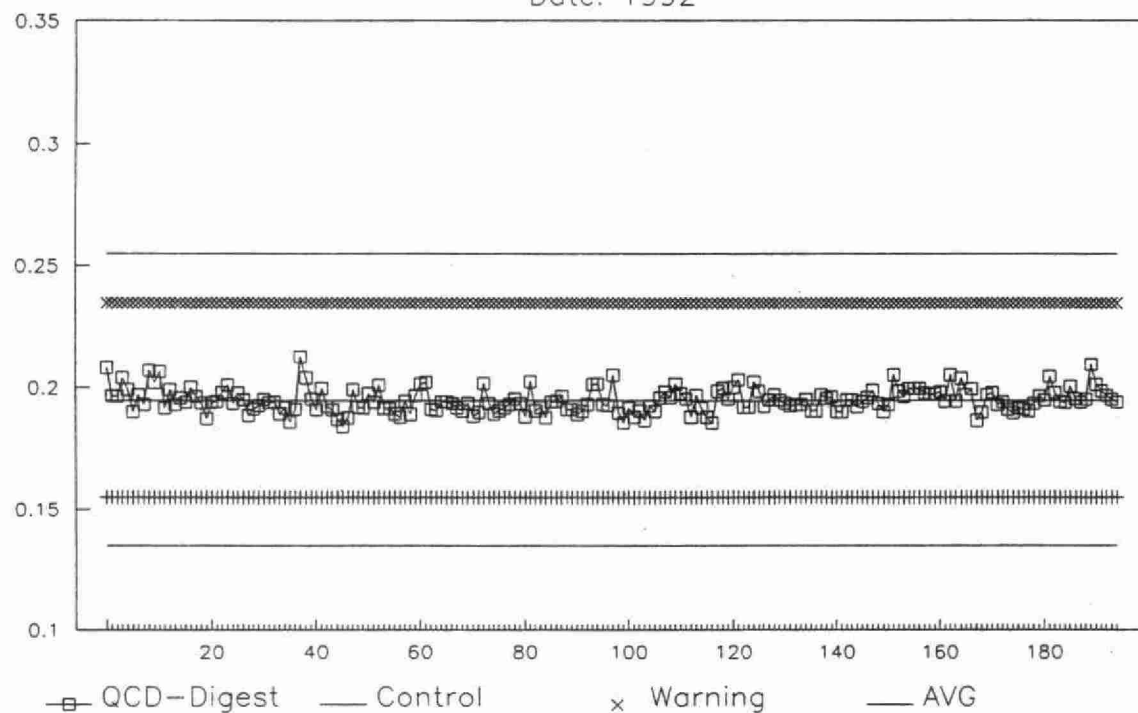
QCC Data — Sr

Date: 1992



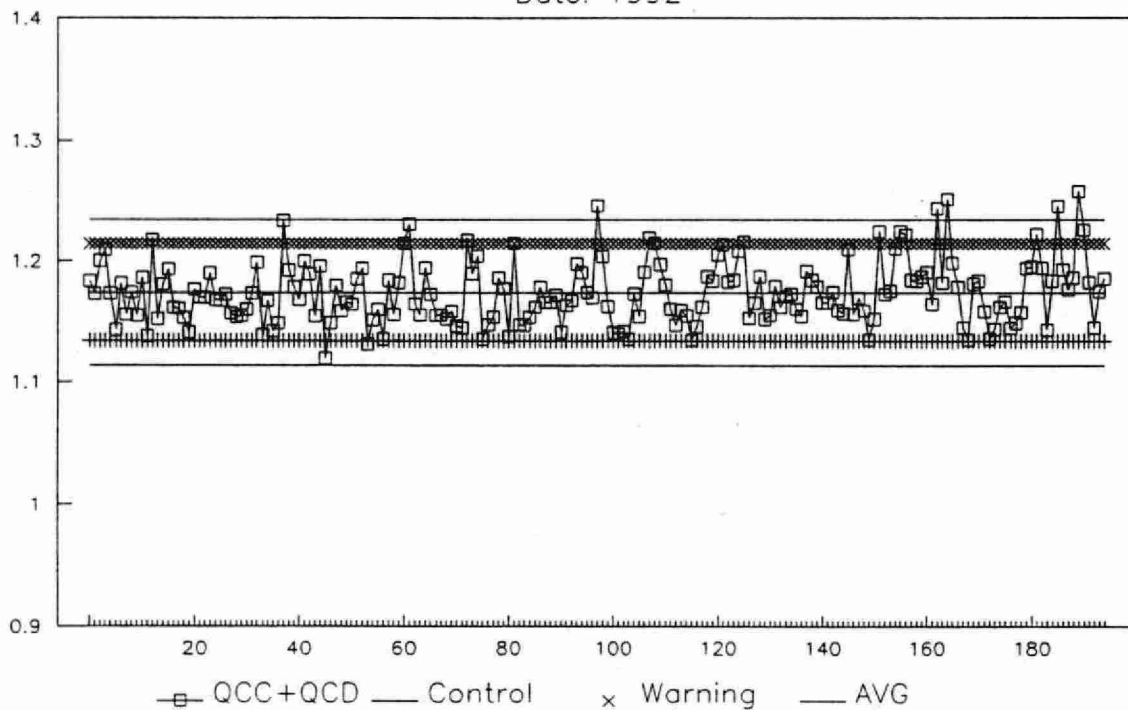
QCD Data — Sr

Date: 1992



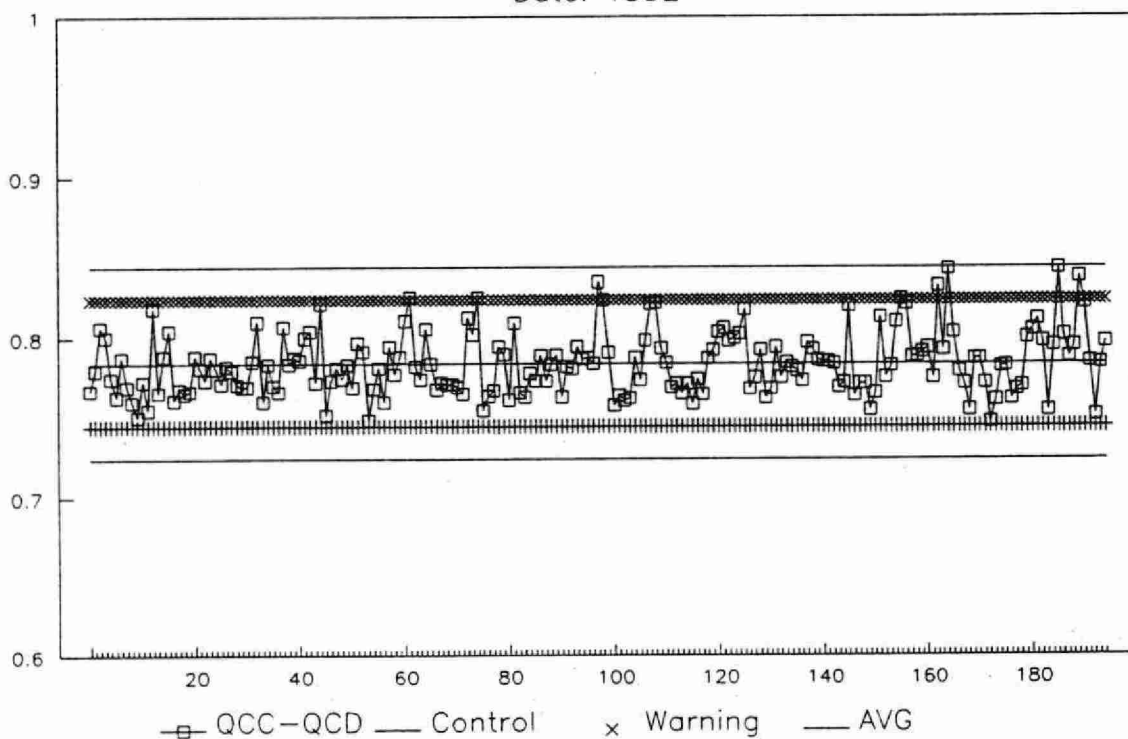
QC Sum Plot — Sr

Date: 1992



QC Difference Plot — Sr

Date: 1992



TITANIUM (TOTAL) – TIUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	190	2.000	1.922	96.1	4.1
QCD:	190	0.400	0.379	94.7	3.5
QCC+QCD:	190	2.400	2.301	95.9	4.2
QCC–QCD:	190	1.600	1.543	96.5	4.7

For 1993 Control Limits:

$$Sw (C-D) = 0.072$$

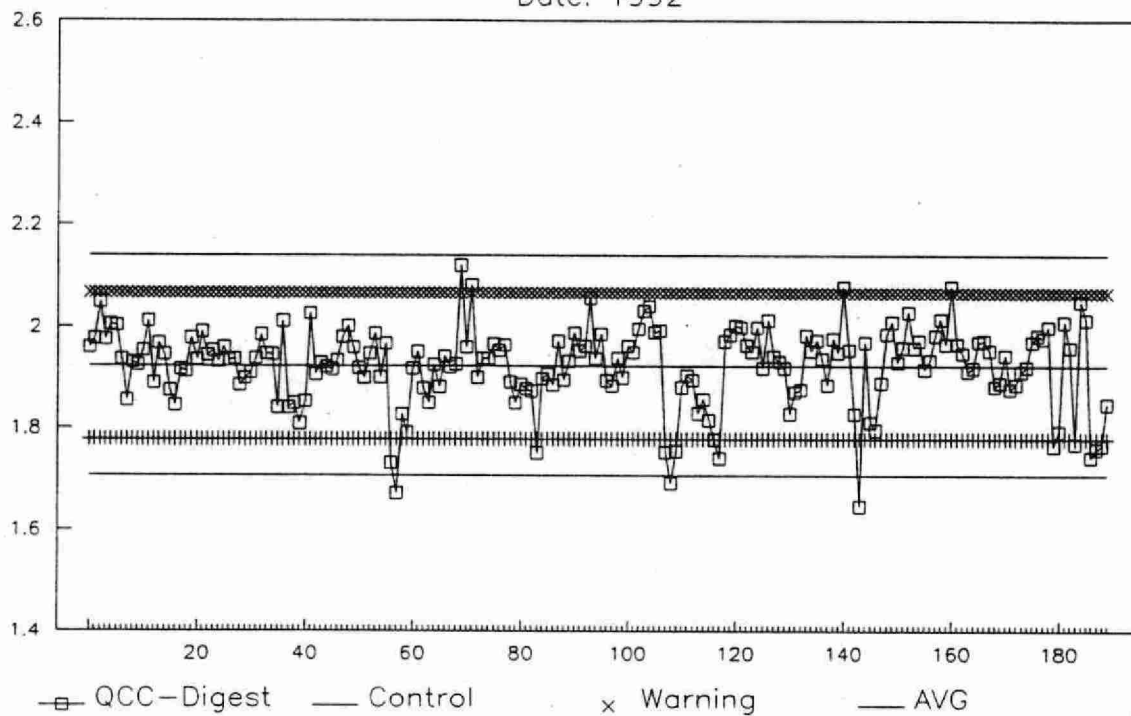
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
149	1	100	4.74	0.7875
5	100	1000	232.7	11.37
0	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

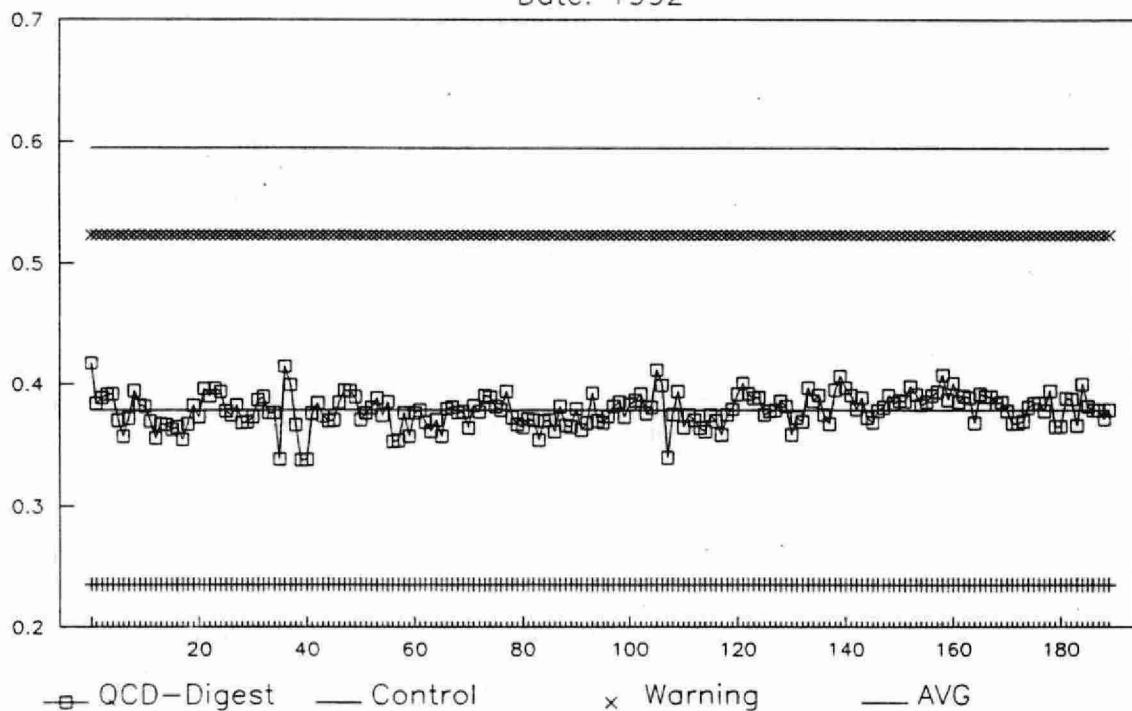
QCC Data — Ti

Date: 1992



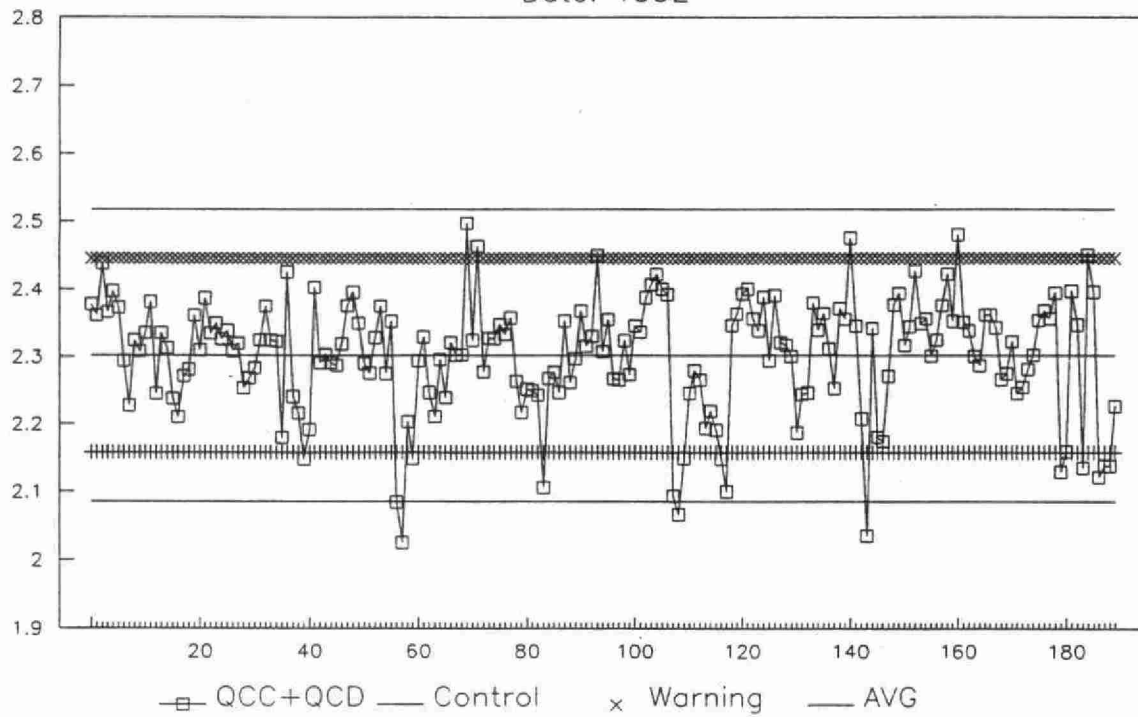
QCD Data — Ti

Date: 1992



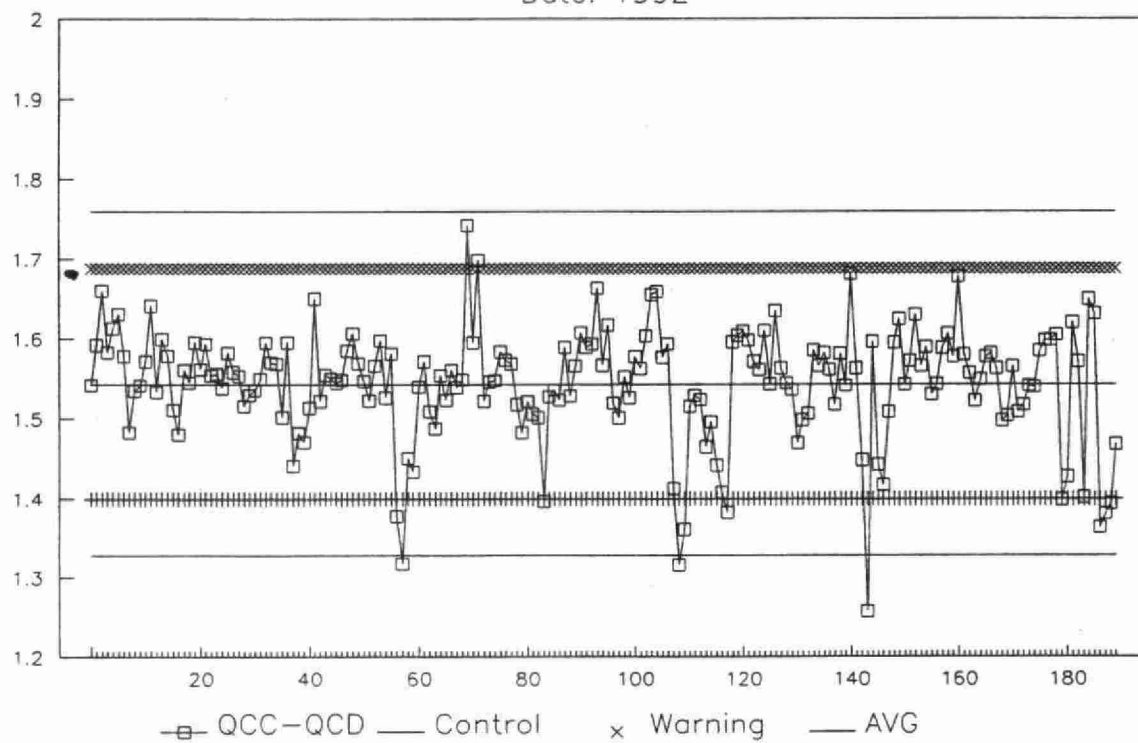
QC Sum Plot — Ti

Date: 1992



QC Difference Plot — Ti

Date: 1992



VANADIUM (TOTAL) – VVUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 2 – 25,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	2.000	1.964	98.2	2.4
QCD:	195	0.400	0.393	98.1	2.7
QCC + QCD:	195	2.400	2.356	98.2	2.3
QCC – QCD:	195	1.600	1.572	98.2	2.6

For 1993 Control Limits:

$$Sw (C-D) = 0.0409$$

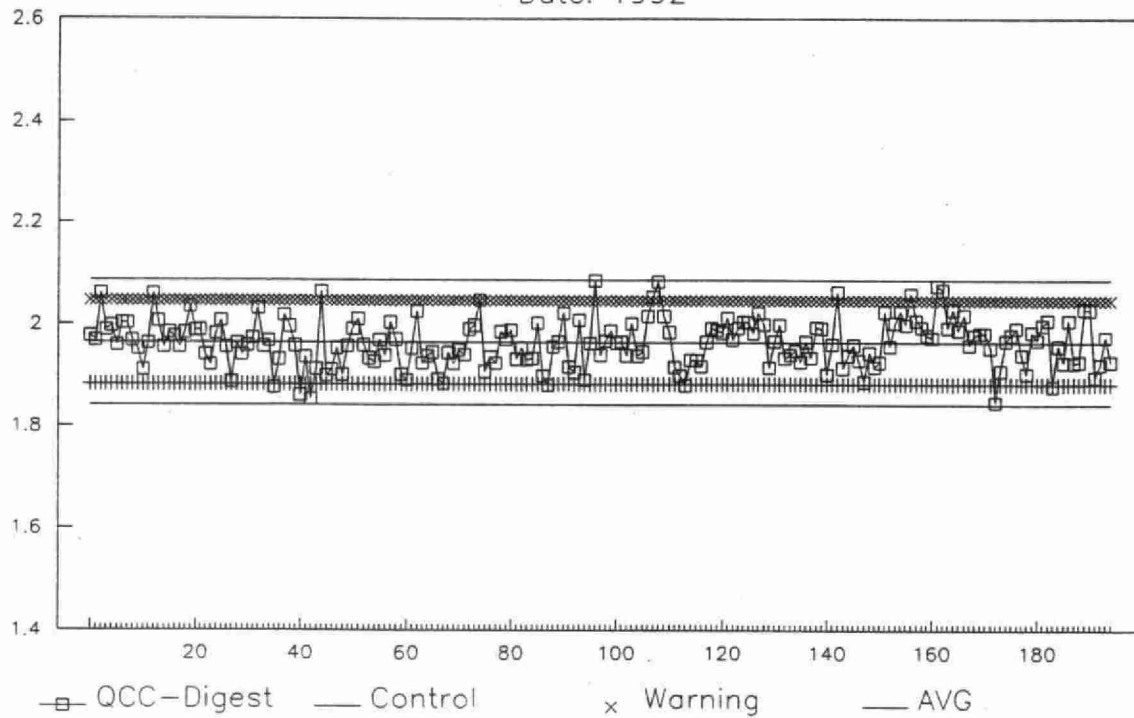
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
152	2	200	1.36	0.1449
0	200	2000	–	–
0	2000	20000	–	–

Detection Limit (DL) = 2 ug/L

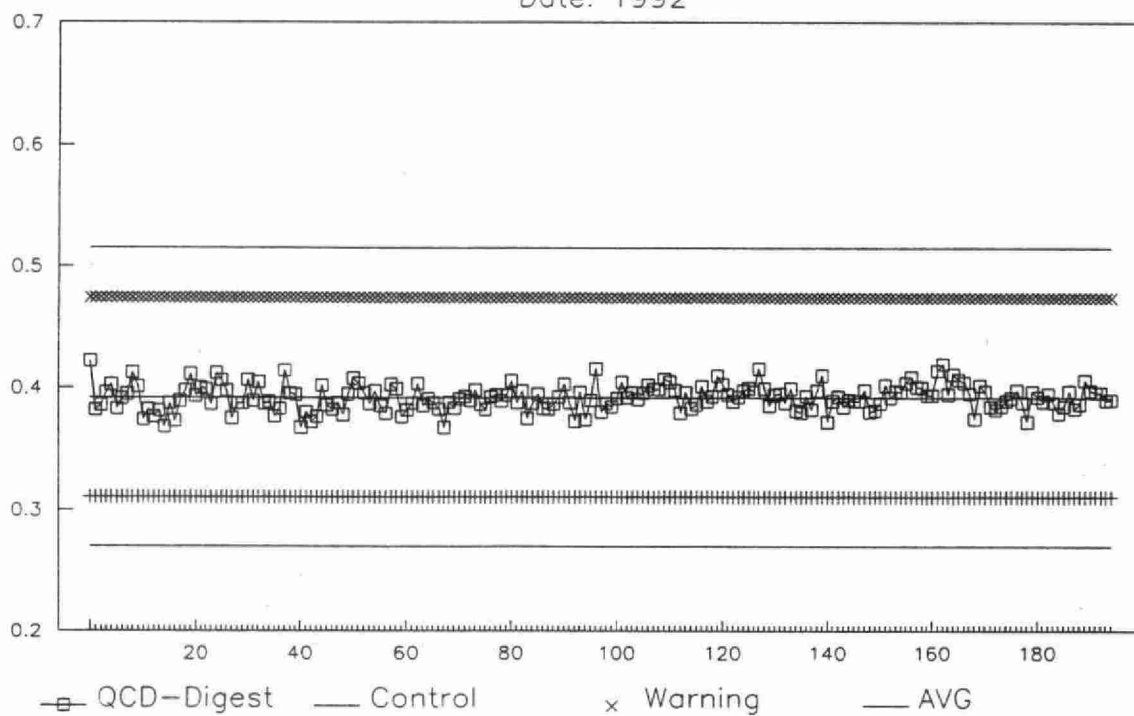
QCC Data — V

Date: 1992



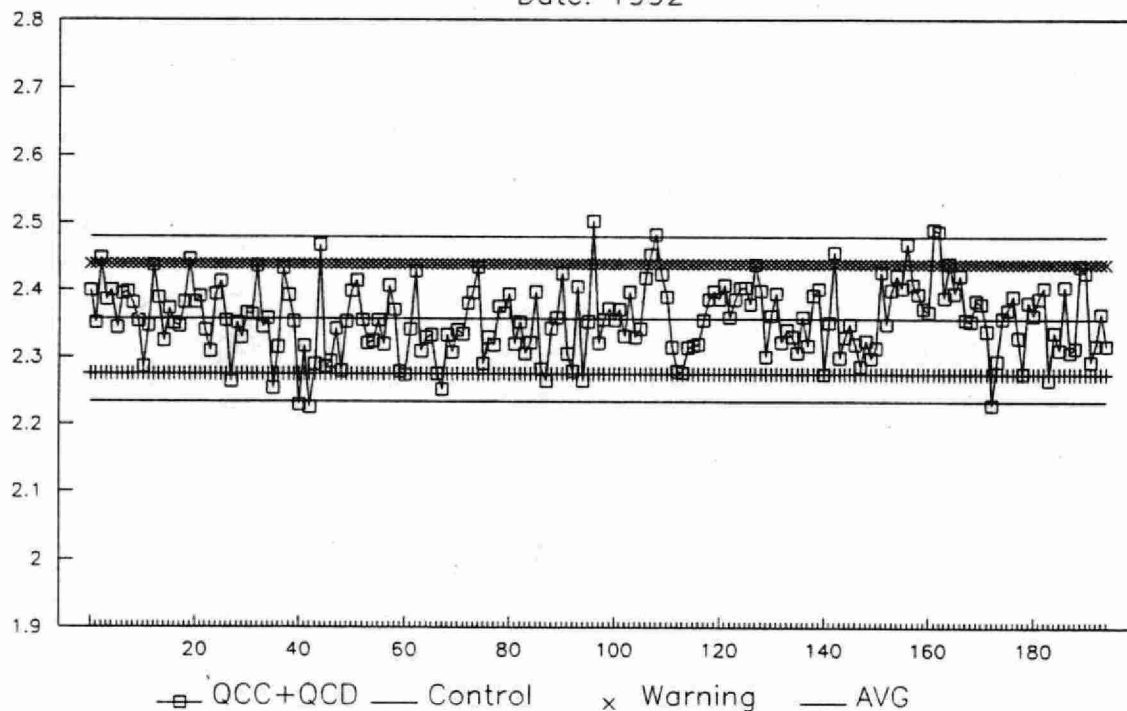
QCD Data — V

Date: 1992



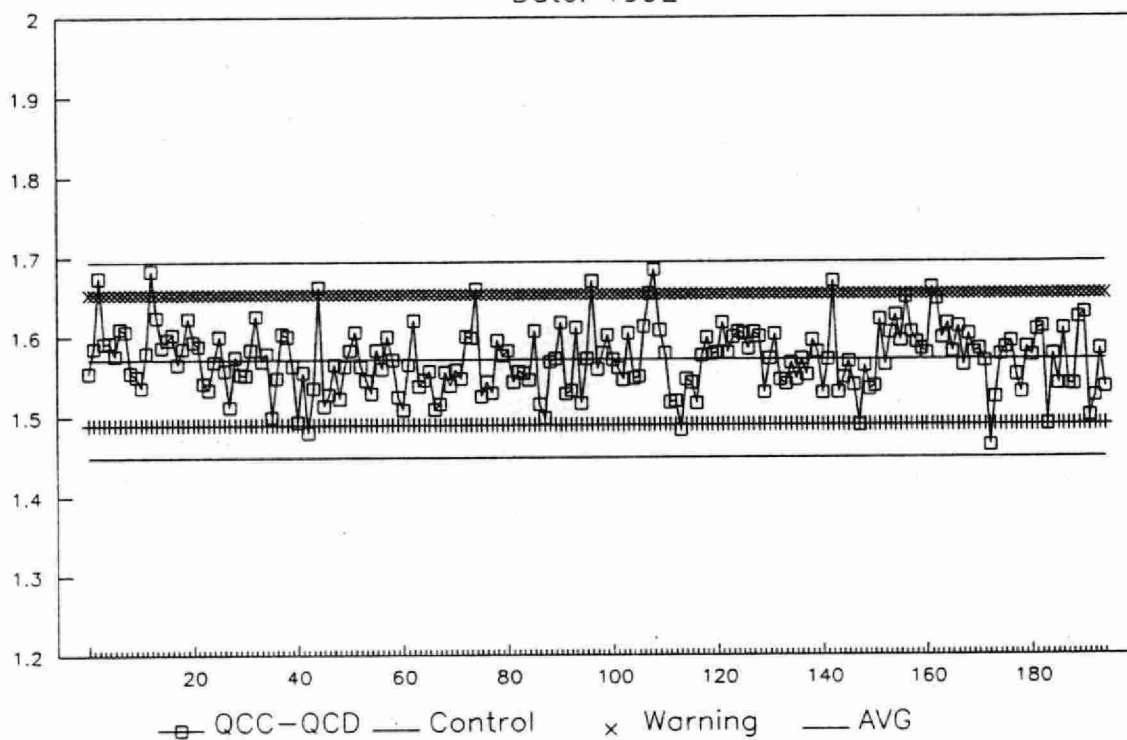
QC Sum Plot - V

Date: 1992



QC Difference Plot - V

Date: 1992



YTTRIUM (TOTAL) – YYUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 20,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	195	1.000	1.002	100.2	2.2
QCD:	195	0.200	0.198	99.2	2.4
QCC+QCD:	195	1.200	1.200	100.0	2.1
QCC–QCD:	195	0.800	0.803	100.4	2.4

For 1993 Control Limits:

$$Sw (C-D) = 0.0194$$

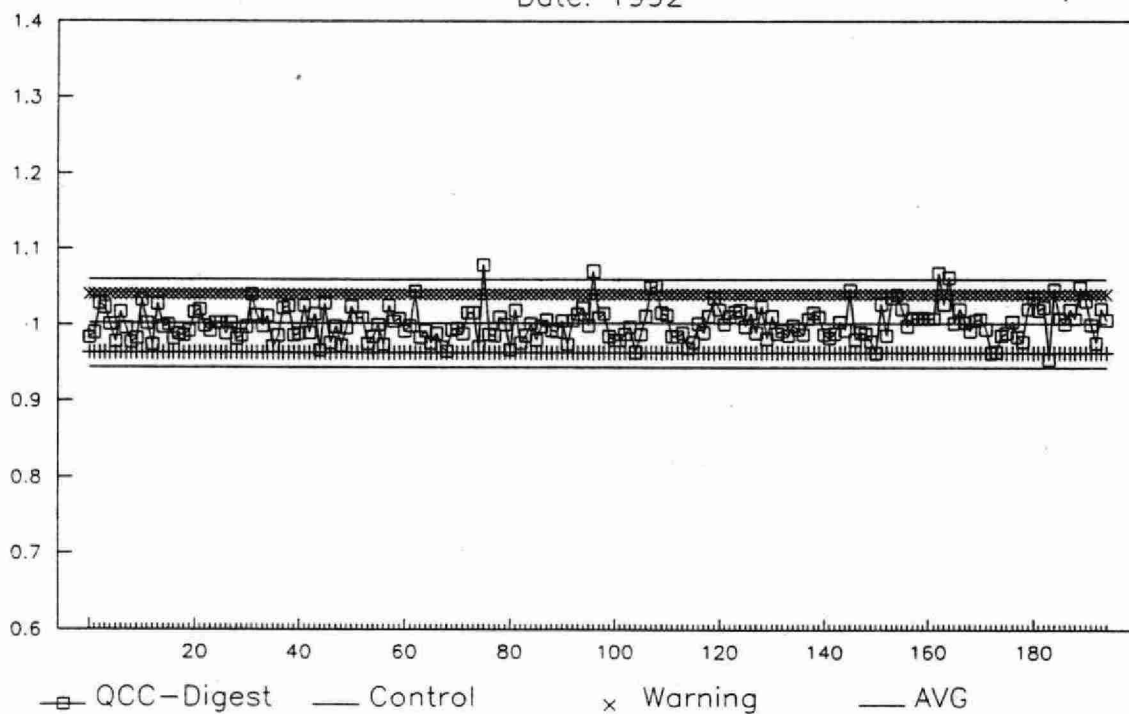
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
144	1	100	0.24	0.0367
0	100	1000	–	–
0	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

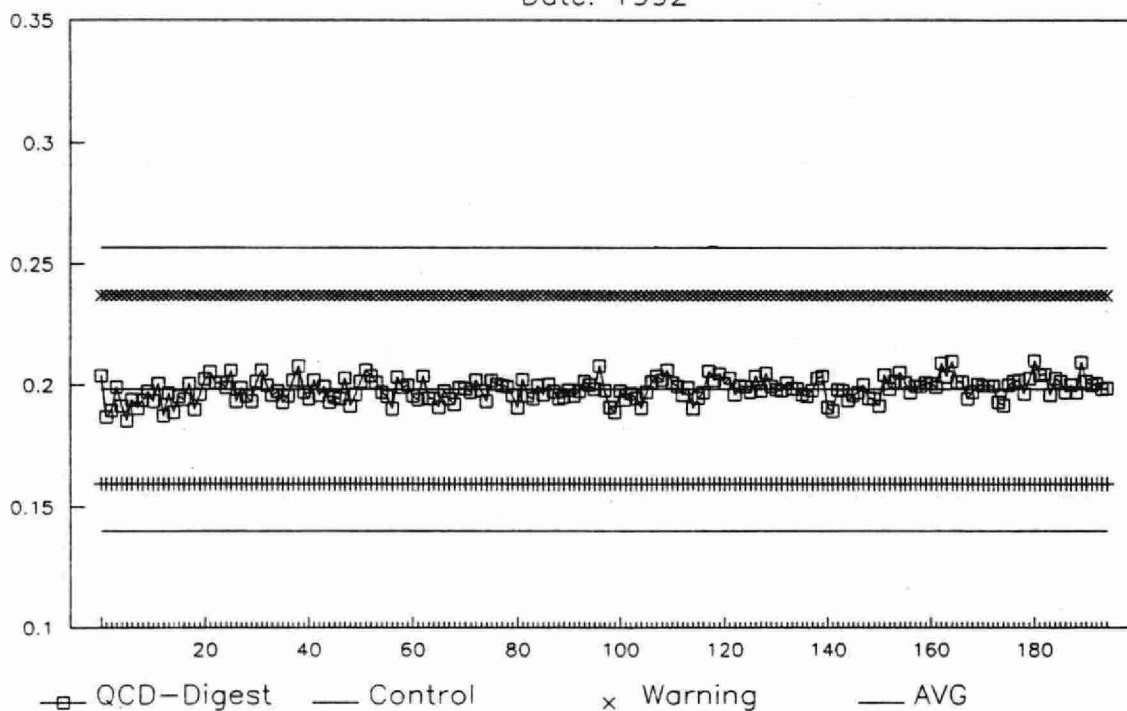
QCC Data — Y

Date: 1992



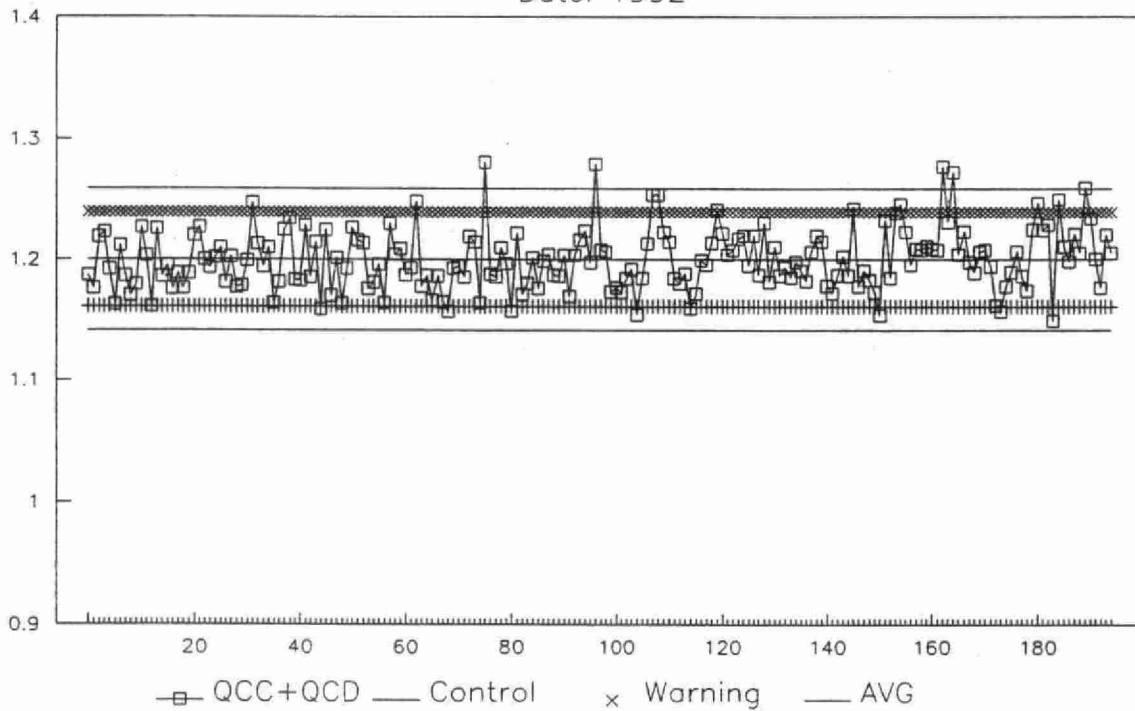
QCD Data — Y

Date: 1992



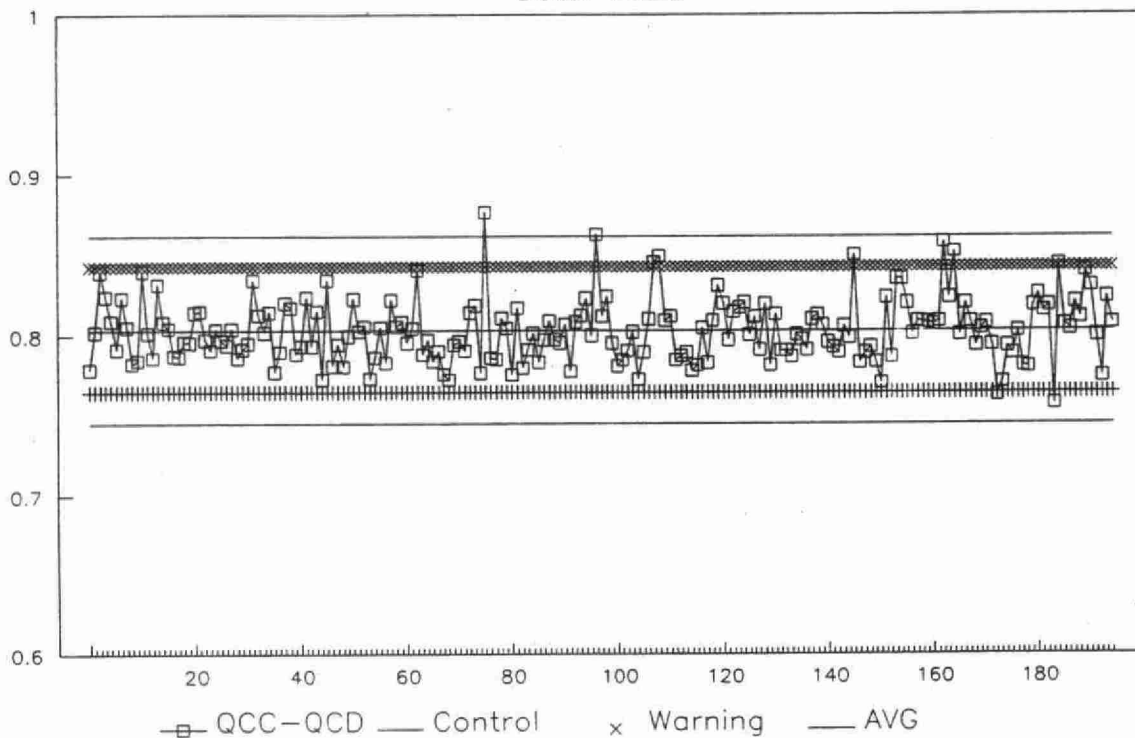
QC Sum Plot — Y

Date: 1992



QC Difference Plot — Y

Date: 1992



ZINC (TOTAL) – ZNUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1 – 15,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	194	2.000	1.987	99.3	1.9
QCD:	194	0.400	0.403	100.8	4.7
QCC+QCD:	194	2.400	2.390	99.6	2.0
QCC–QCD:	194	1.600	1.584	99.0	2.2

For 1993 Control Limits:

$$Sw (C-D) = 0.0355$$

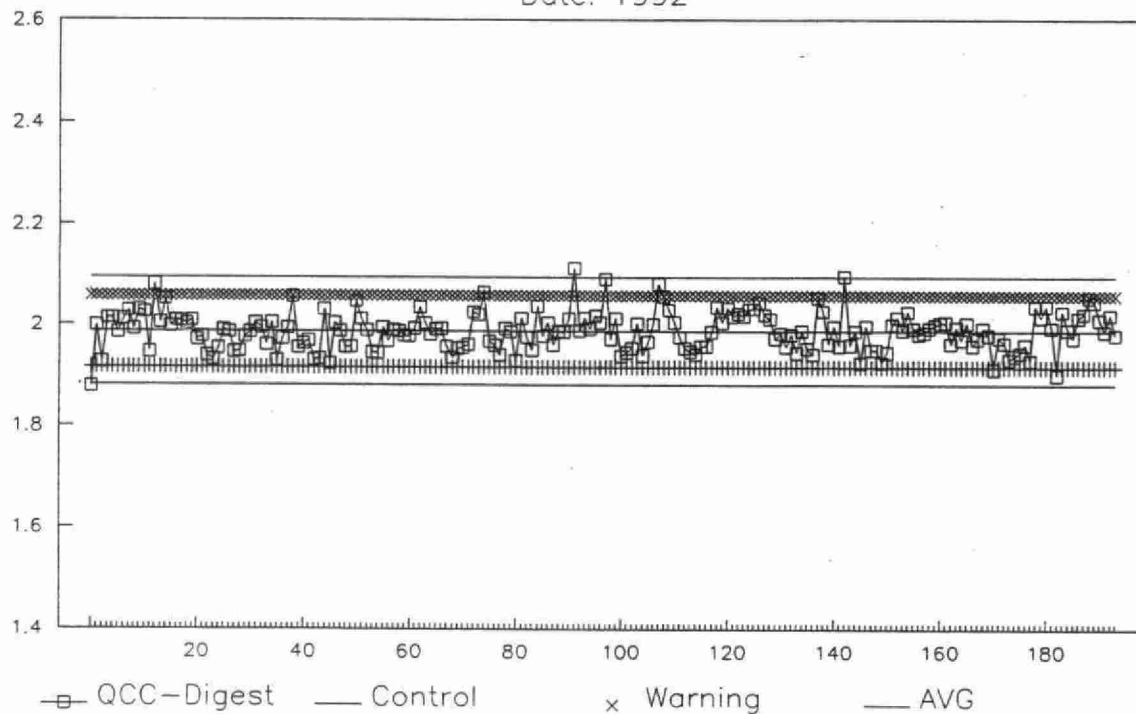
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
144	1	100	10.25	0.5622
10	100	1000	287.8	4.26
N/A	1000	10000	–	–

Detection Limit (DL) = 1 ug/L

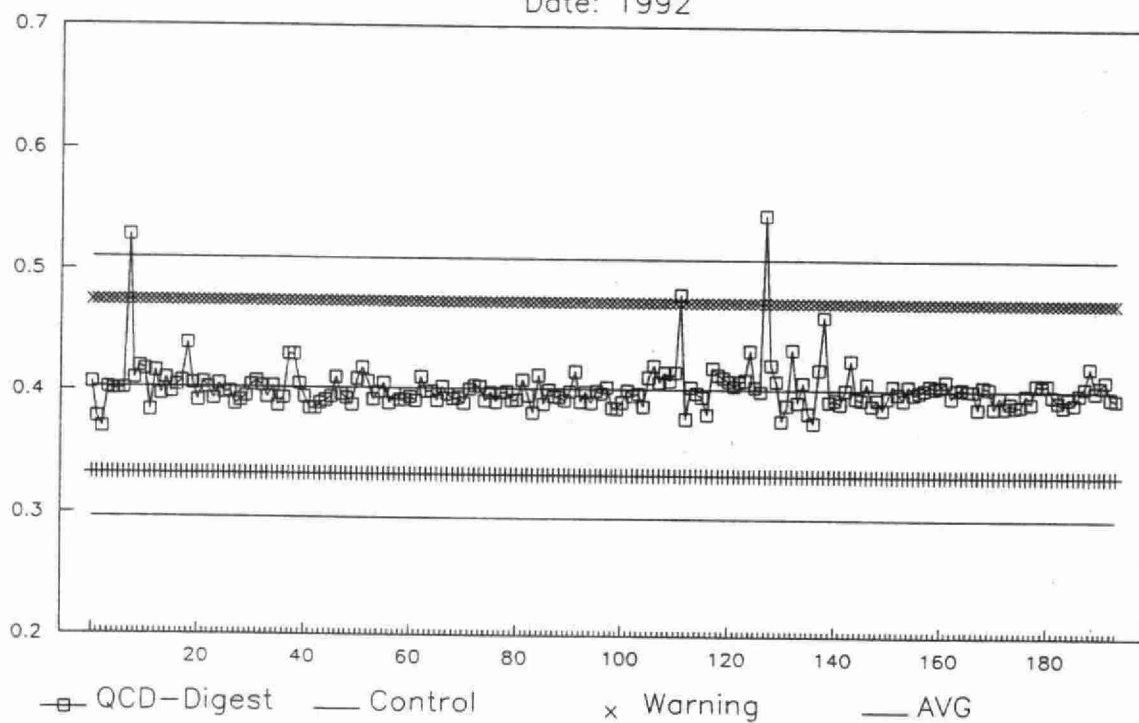
QCC Data — Zn

Date: 1992



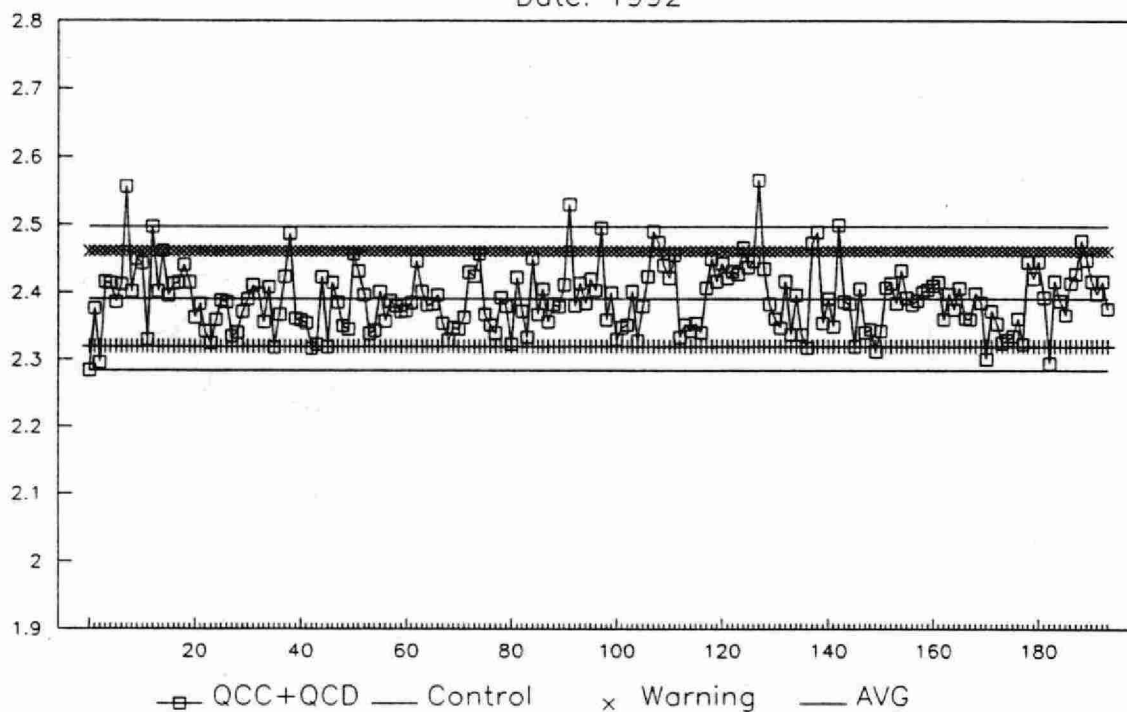
QCD Data — Zn

Date: 1992



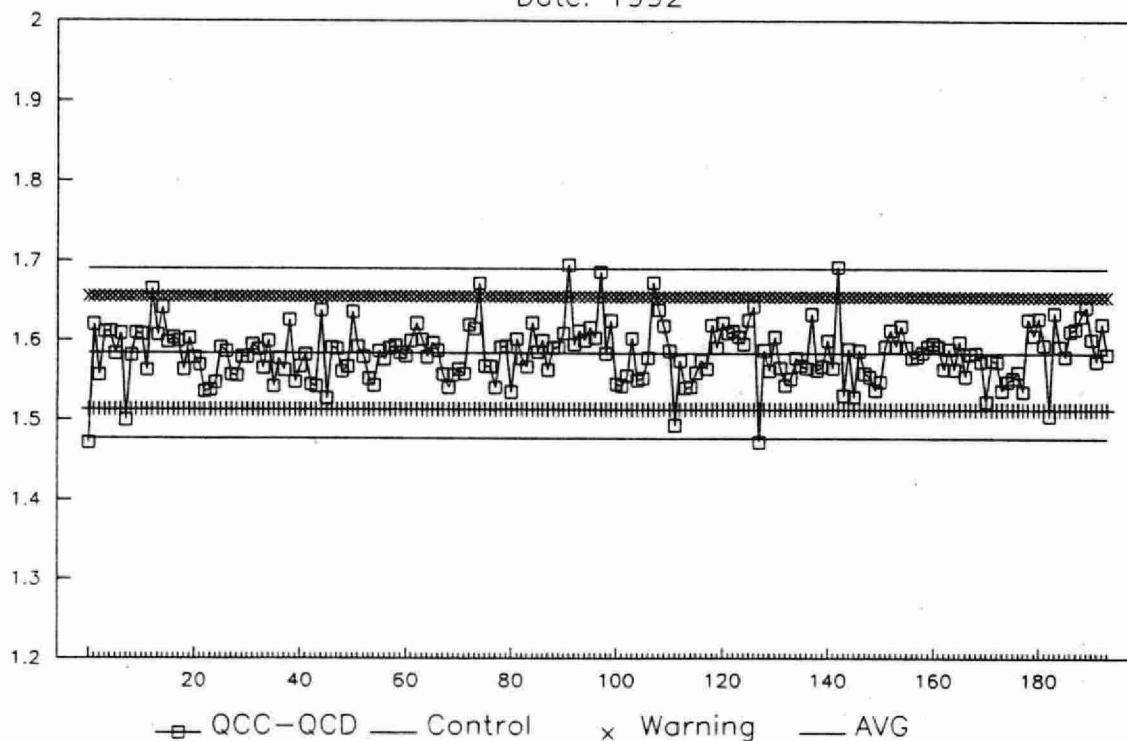
QC Sum Plot — Zn

Date: 1992



QC Difference Plot — Zn

Date: 1992



MAJOR CATIONS

IDENTIFICATION:

Method Title: The Determination of Sodium, Potassium, Calcium, and Magnesium in Water, Sewage, Leachates and Industrial Wastes by Sequential ICP-AES.

Work Station Code: TBSOFT Date Introduced: November, 1991
Method Code: E6047A Section: Trace Contaminants

PARAMETERS:	<u>LIS Code</u>	<u>W (mg/L)</u>	<u>T(mg/L)</u>
Sodium	NAUR	.05	.25
Potassium	KKUR	.02	.10
Calcium	CAUR	.05	.25
Magnesium	MGUR	.02	.10

SAMPLE TYPE/MATRIX:

Sewage, Surface Waters, Landfills, Drinking Waters, Leachates, and Industrial Waters

ANALYTICAL PROCEDURE:

Concentrations in solution are determined by inductively coupled argon plasma emission spectroscopy. Samples containing less than 1 ppm potassium are analyzed by atomic absorption spectroscopy, which has a lower detection limit for potassium.

INSTRUMENTATION:

Atomic Emission Spectrometer, Thermo Jarrell Ash Atomscan 25 with Thermo Jarrell Ash Model TJA 300 Autosampler; Linear, 2 point or 3 point calibration; Standards are prepared in 1% HNO₃

Varian Model 1475 Atomic Absorption Spectrometer with Varian Model 55 Autosampler

CONTROLS AND QUALITY ASSURANCE:

Control: Blank, Veg 7

Ref. Material: SLRS-2 (National Research Council, Canada)

Drift: Veg 7 run every 10 samples

Duplicates: 1 every 20 samples

Interlabs: QM Office Blind Audit Program - bimonthly
LRTAP (Fisheries and Oceans, Canada)-3x annually
Great Lakes Action Program (GLAP, 2x annually)
CAEAL Certification Round Robin (2x annually)

Reporting: Units: ppm (mg/L)
Sig. Figures: 2

REMARKS:

CALCIUM (REACTIVE) – CAUR

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.05 – 500 mg/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% of Target	% Rel. Std. Dev.
VEG7:	125	40.0	39.400	98.5	1.9

Duplicates:

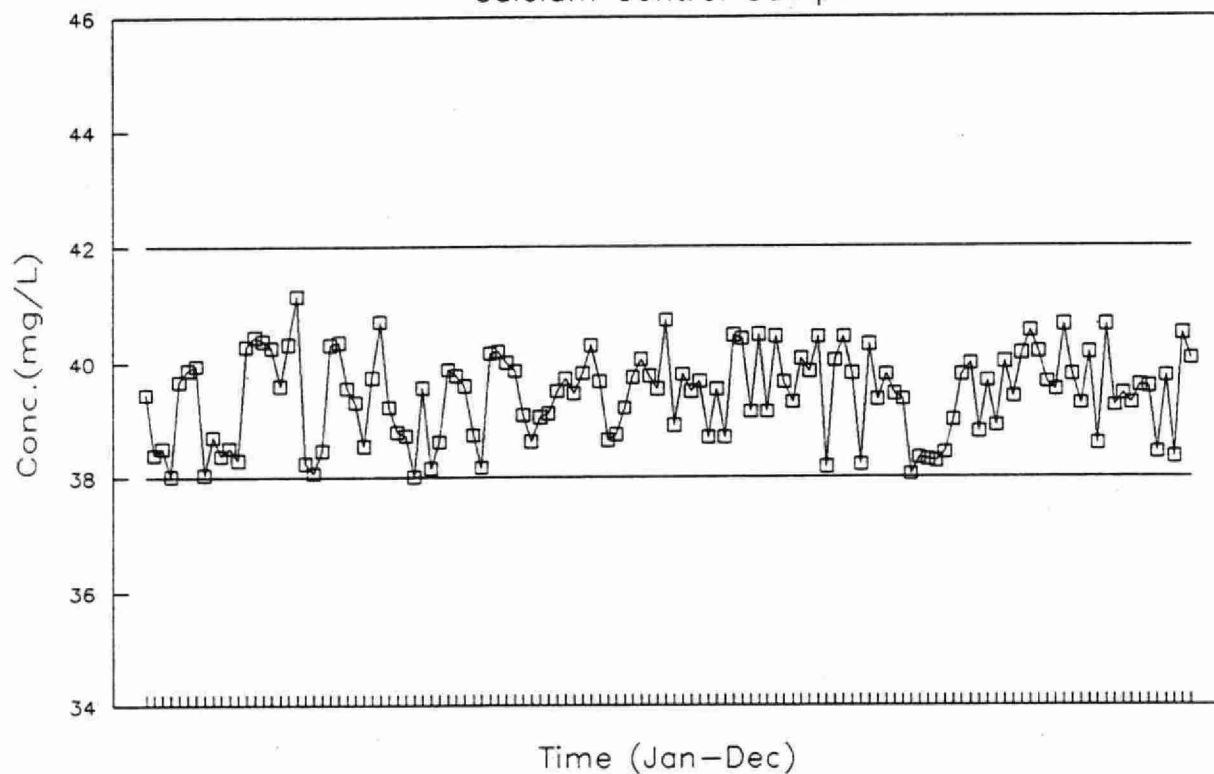
Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
43	0.05	5	2.39	0.051
79	5	50	23.0	0.45
41	50	500	114	7.6

Detection Limit (DL) =

0.05 mg/L

1992 Soft Metals QC Data

Calcium Control Sample



MAGNESIUM (REACTIVE) – MGUR

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.05 – 200 mg/L

Calibration Control:

	Number of Data	Target Conc.	Avg. Conc. Measured	% of Target	% Rel. Std. Dev.
VEG7:	100	10.0	10.300	103.0	3.0

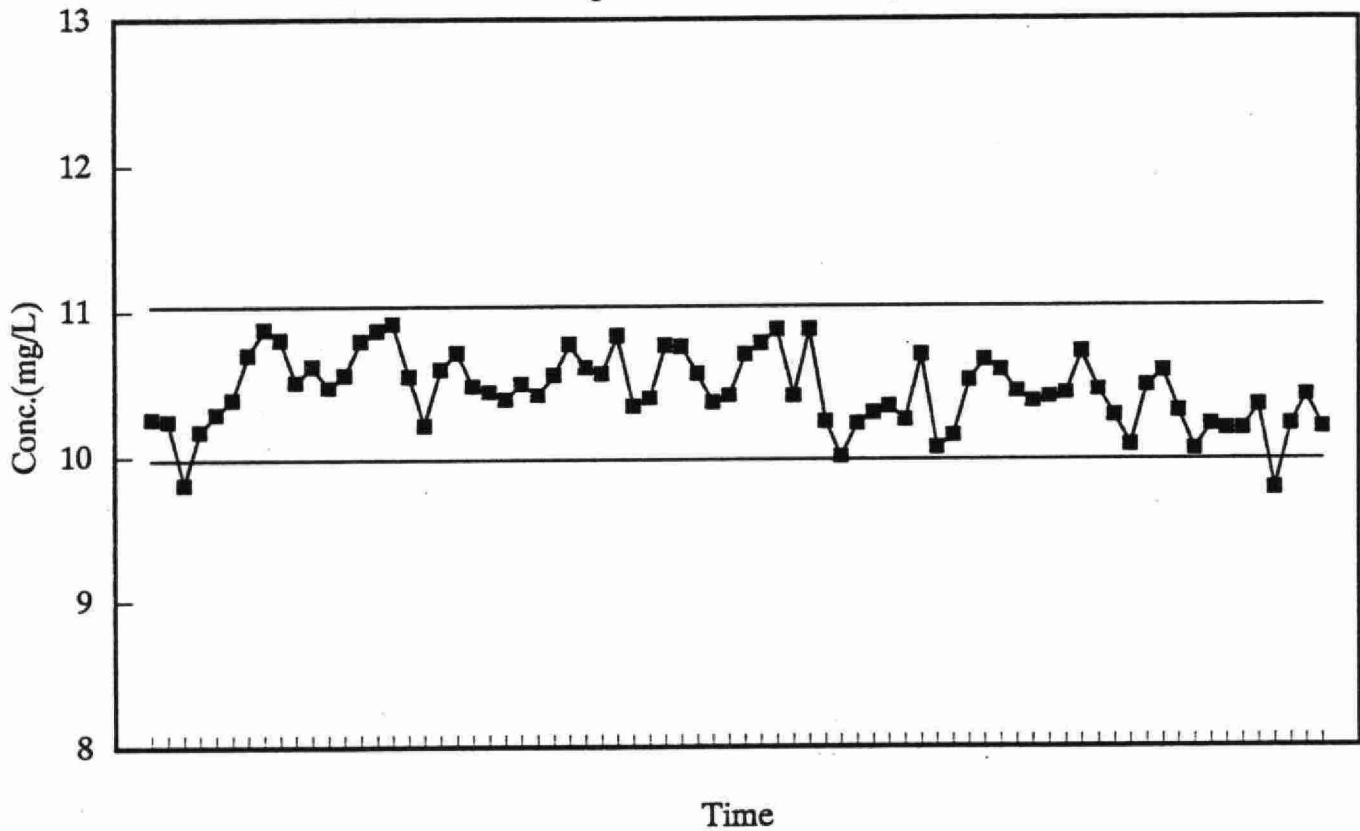
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
51	0.05	5	0.75	0.014
85	5	50	7.7	0.34
23	50	500	38.7	0.8

Detection Limit (DL) =

1992 Soft Metals QC Data

Magnesium Control Sample



— Control Limits (5%)

SODIUM (REACTIVE) – NAUR

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.05 – 500 mg/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% of Target	% Rel. Std. Dev.
VEG7:	150	20.0	19.8	99.0	2.1

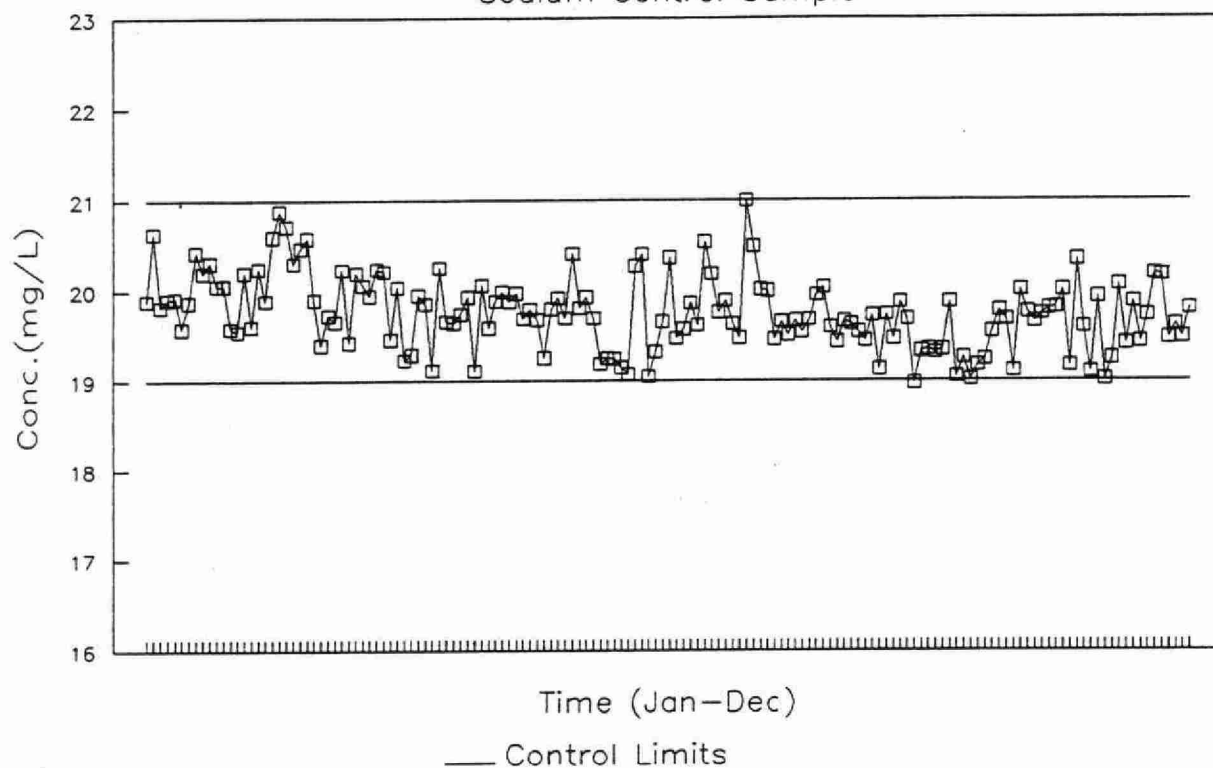
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
120	0.05	5	1.94	0.072
121	5	50	17.0	0.439
37	50	500	188	2.4

Detection Limit (DL) = 0.05 mg/L

1992 Soft Metals QC Data

Sodium Control Sample



POTASSIUM (REACTIVE) – KKUR

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.05 – 250 mg/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% of Target	% Rel. Std. Dev.
VEG7:	131	20.0	19.400	97.0	2.4

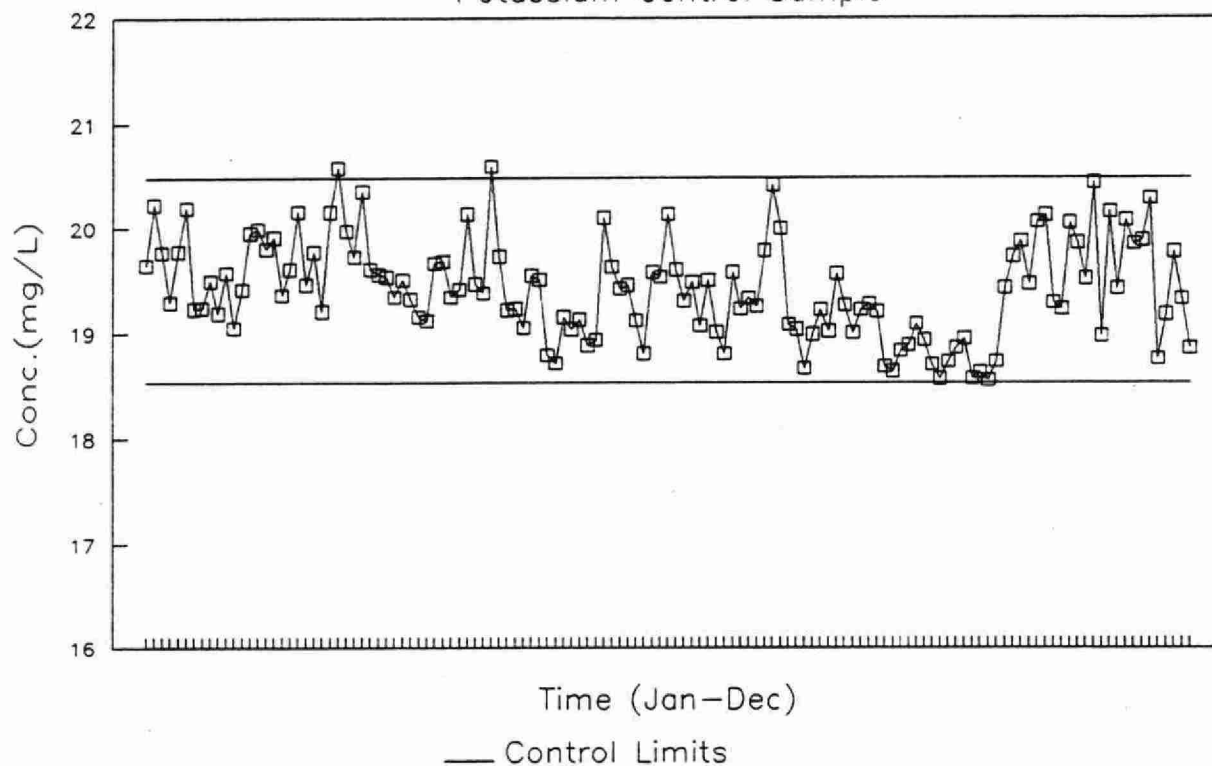
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
186	0.05	5	2.07	0.256
5	5	50	96.4	1.74
0	50	500	—	—

Detection Limit (DL) = 0.05 mg/L

1992 Soft Metals QC Data

Potassium Control Sample



BORON

IDENTIFICATION:

Method Title: The Determination of Boron in Water by ICP-AES.

Work Station Code: TBBORON
Method Code: E6036A

Method Introduced: June, 1988
Section: Trace Contaminants

PARAMETER:	<u>LIS Code</u>	<u>W (mg/L)</u>	<u>T(mg/L)</u>
Boron	BBUT	5	25

SAMPLE TYPE/MATRIX:

Domestic water, surface water, groundwater, industrial wastes, landfill, test wells, etc.

ANALYTICAL PROCEDURE:

Sample is aspirated without pretreatment into the analytical instrument. Concentration is determined by intensity of light emission.

INSTRUMENTATION:

Thermo Jarrell Ash ICAP61 Inductively Coupled Plasma Spectrometer; Linear 2-point calibration, 0-2.5 mg Boron/L

QUALITY ASSURANCE:

Controls: Blank, ICAP7 (1.0 ug/mL)

Ref. Material: ICAP7 (EPA)

Drift: QCBOR (0.5 ug/mL) analyzed every 10 samples

Duplicates: 1 per 10 samples

Interlabs: MOEE Blind Audit Program
Great Lakes Action Program (GLAP)- 2x annually

Reporting: Units: ug/L
Sig. Figures: 2

REMARKS:

BORON (TOTAL) – BBUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range – 1–10,000 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% of Target	% Rel. Std. Dev.
QCBOR:	23	0.5	0.505	101.0	8.24

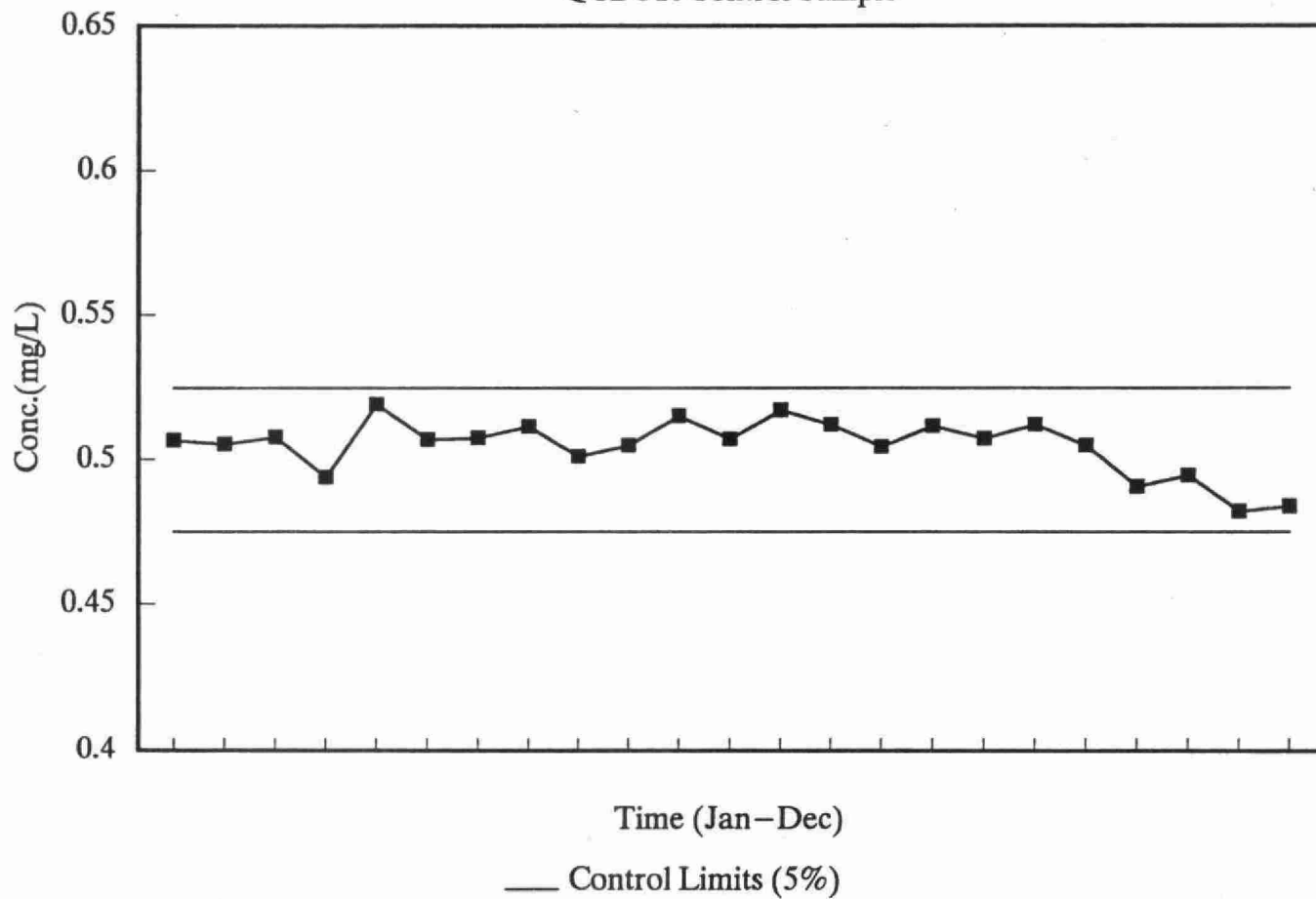
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
53	5	500	13.73	2.296
13	500	5000	136.2	3.52
2	5000	50000	993	55

Detection Limit (DL) = 5 ug/L

1992 Boron QC Data

QCBOR Control Sample



MERCURY

IDENTIFICATION:

Method Title: The Determination of Mercury in Water, Industrial Waste and Sewage by AAS.

Work Station Code: TBHGW Date Introduced: 1980
Method Code: E6014A Section: Trace Contaminants

PARAMETERS:	<u>LIS Code</u>	<u>W (ug/L)</u>	<u>T(ug/L)</u>
Mercury	HGUT	.01	.05

SAMPLE TYPE/MATRIX:

Domestic water, surface water, groundwater, industrial waste, landfill test wells, sewage, etc.

ANALYTICAL PROCEDURE:

Mercury in the sample is converted to the inorganic form by acid digestion. The mercury is then reduced being stannous chloride and the concentration measured by cold vapour atomic absorption spectroscopy.

INSTRUMENTATION:

Pharmacia Model 100M Mercury Monitor; Linear, five point calibration.

QUALITY ASSURANCE:

Controls:	QCA, QCB
Ref. Materials:	EPA1, EPA2
Drift:	Standards reanalyzed every 20 samples
Duplicates:	1 per 20 samples
Interlabs:	MOEE Blind Audit Program
Reporting:	Units: ug/L (ppb) Sig. Figures: 2

REMARKS:

MERCURY (TOTAL) – HGUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.01 – 0.4 ug/L (ppb)

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCC:	45	0.300	0.295	98.3	3.5
QCD:	45	0.100	0.101	101.0	4.9
QCC + QCD:	45	0.400	0.395	98.8	3.2
QCC – QCD:	45	0.200	0.194	97.0	5.4

For 1993 Control Limits:

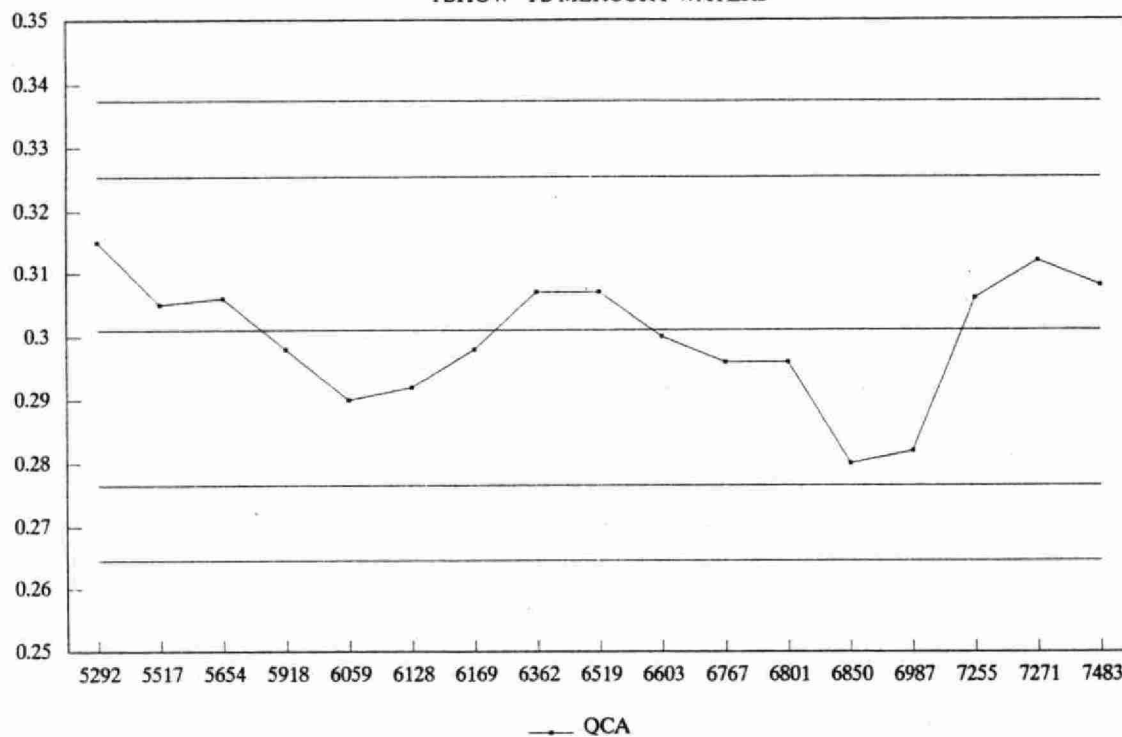
$$Sw (C-D) = 0.0104$$

Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
52	0.01	0.08	0.0113	0.0058
0	0.08	0.2	NA	NA
0	0.2	0.4	NA	NA

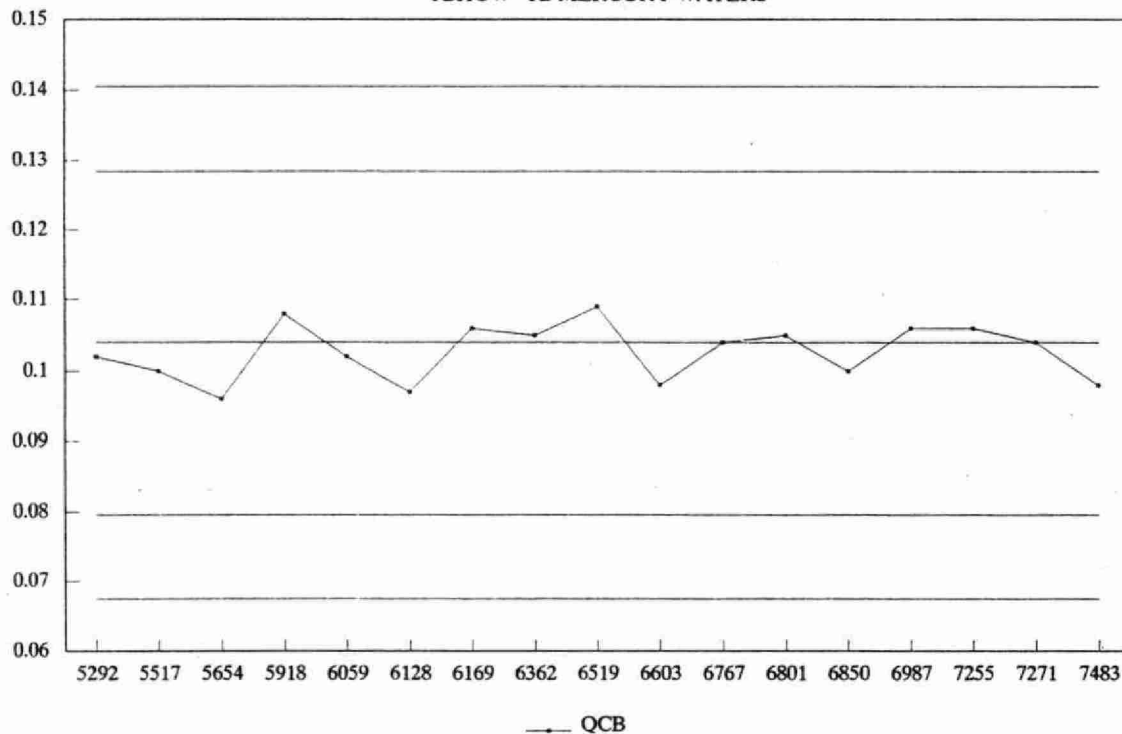
Detection Limit (DL) = 0.01 ug/L

TBHGW TB MERCURY WATERS



Feb. 14, 1992 - Nov. 27, 1992
Runs: 5292 - 7483

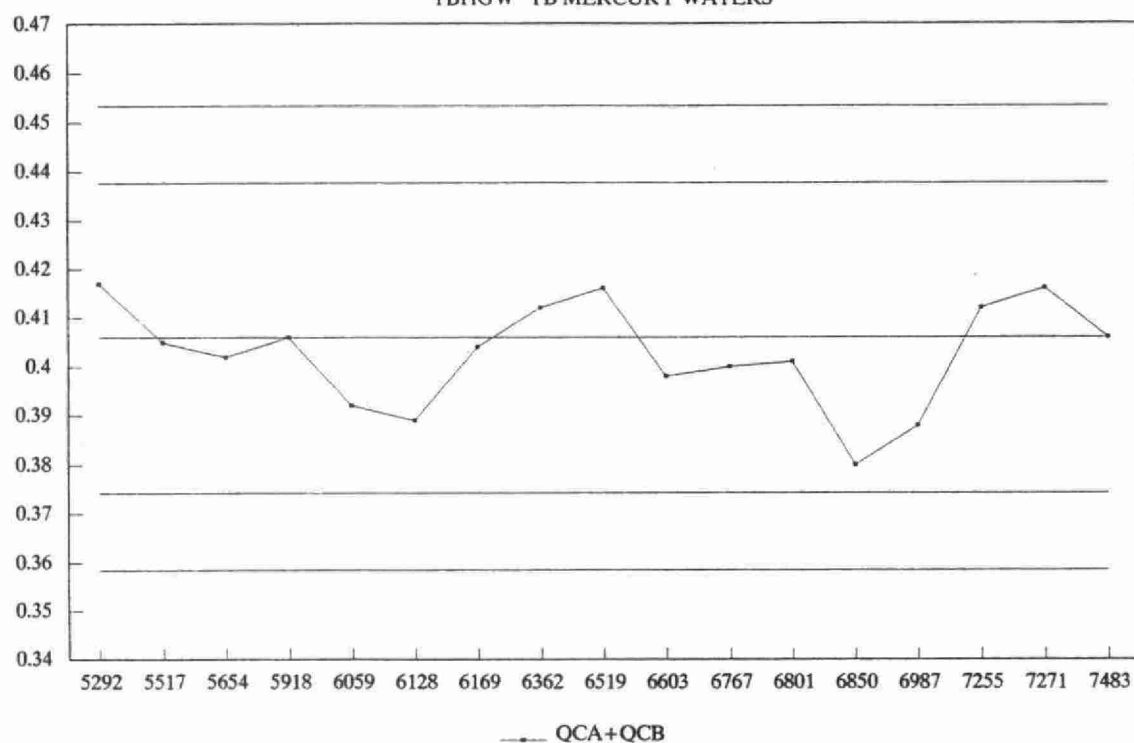
TBHGW TB MERCURY WATERS



Feb. 14, 1992 - Nov. 27, 1992
Runs: 5292 - 7483

HGUTW MERCURY, UNF. TOTAL

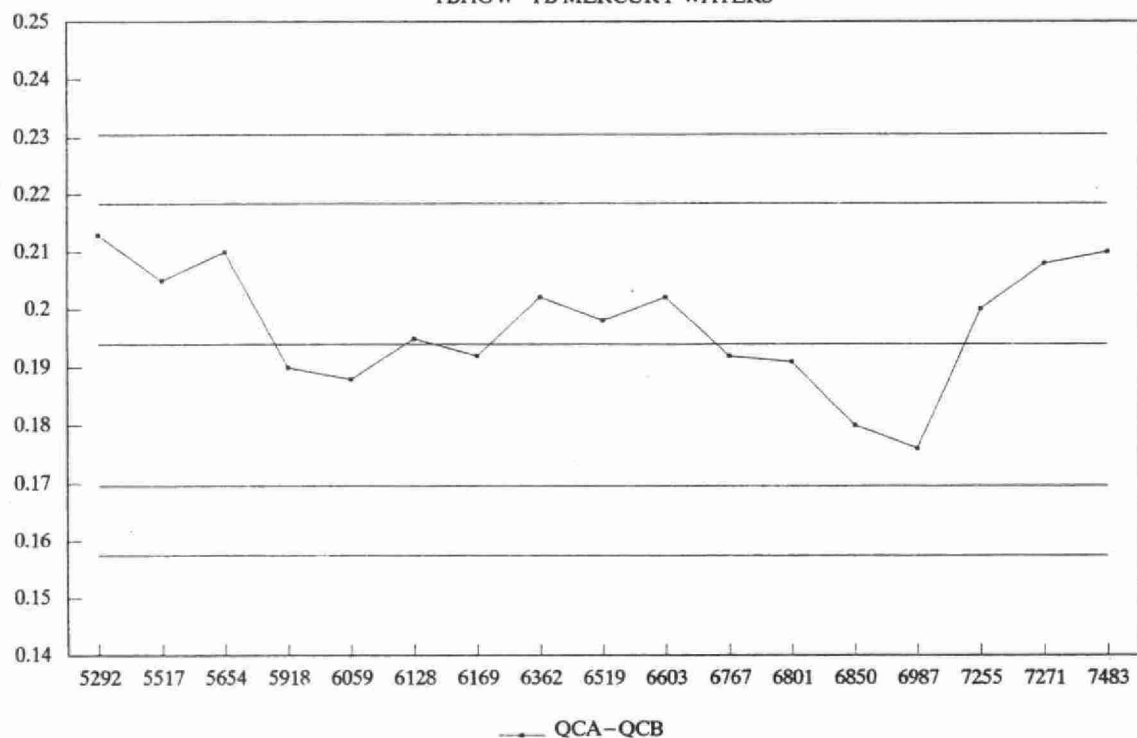
TBHGW TB MERCURY WATERS



Feb. 14, 1992 - Nov. 27, 1992
Runs: 5292 - 7483

HGUTW MERCURY, UNF. TOTAL

TBHGW TB MERCURY WATERS



Feb. 14, 1992 - Nov. 27, 1992
Runs: 5292 - 7483

Arsenic, Selenium, Antimony

IDENTIFICATION:

Method Title: The Determination of Arsenic, Selenium and Antimony in Surface and Drinking Water by Hydride AAS.

Work Station Code: TBHYDW Date Introduced: 90/04/10
Method Code: E6038A Section: Trace Contaminants

PARAMETER:	<u>LIS Code</u>	<u>W (ug/L)</u>	<u>T(ug/L)</u>
Arsenic	ASUT	.2	1.0
Selenium	SEUT	.2	1.0
Antimony	SBUT	.2	1.0

SAMPLE TYPE/MATRIX:

Surface, drinking waters, landfill leachates, and industrial effluent

ANALYTICAL PROCEDURE:

Samples are digested in oxidizing acid mixtures to oxidize all forms. It is reduced by sodium borohydrate and swept into a heated quartz tube by argon carrier gas. Concentration is determined by flameless atomic absorption spectrometry.

INSTRUMENTATION:

Varian AA-6 Automated AAS System with quartz cell;
Logarithmic, 6-Standard calibration, 0.0-40.0 ug/L

CONTROLS AND QUALITY ASSURANCE:

Controls: Blank, QCA, QCB,

Ref. Material: EPA #18, PP42

Drift: 10.0 and 30.0 ug/L standards every 10 samples

Duplicates: 1 for every 13 samples, run throughout run

Interlabs: MOEE Blind Audit Program
Great Lakes Action Program (2x annually)

Reporting: Units: ug/L
Sig. Figures: 2

REMARKS:

ARSENIC (TOTAL) – ASUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 1.0 – 40 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCA:	42	40.000	39.796	99.5	2.2
QCB:	42	10.000	10.434	104.3	5.5
QCA+QCB:	42	50.000	50.230	100.5	2.5
QCA-QCB:	42	30.000	29.363	97.9	2.9

For 1993 Control Limits:

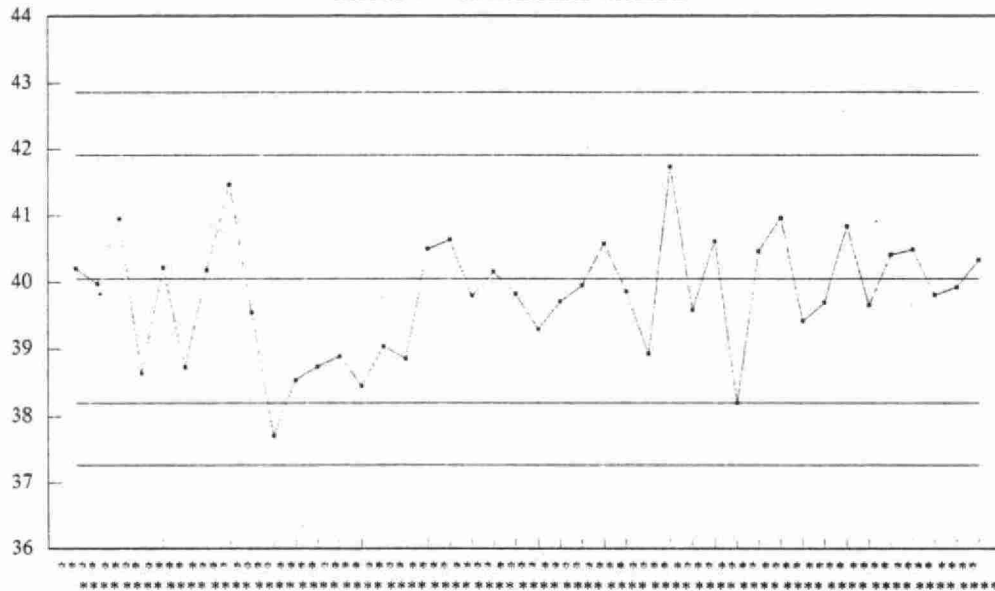
$$Sw (A-B) = 0.838$$

Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
139	0.2	8	1.08	0.17
4	8	20	12.3	0.55
4	20	40	26.00	0.22

Detection Limit (DL) = 0.2 ug/L

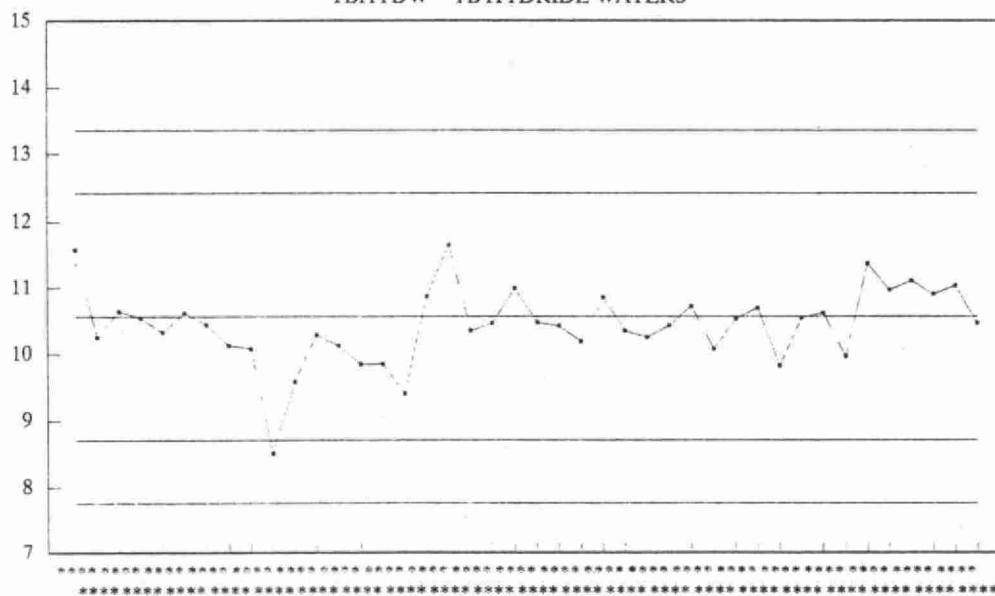
ASUT ARSENIC, UNF. TOTAL TBHYDW TB HYDRIDE WATERS



— QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5004 - 7566

ASUT ARSENIC, UNF. TOTAL TBHYDW TB HYDRIDE WATERS

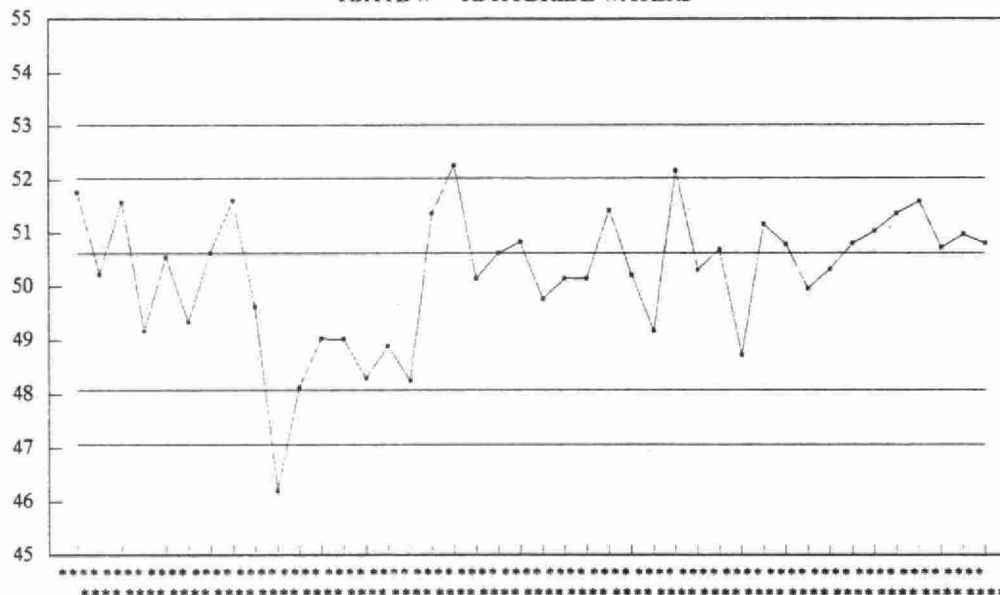


— QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 5004 - 7566

ASUT ARSENIC, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

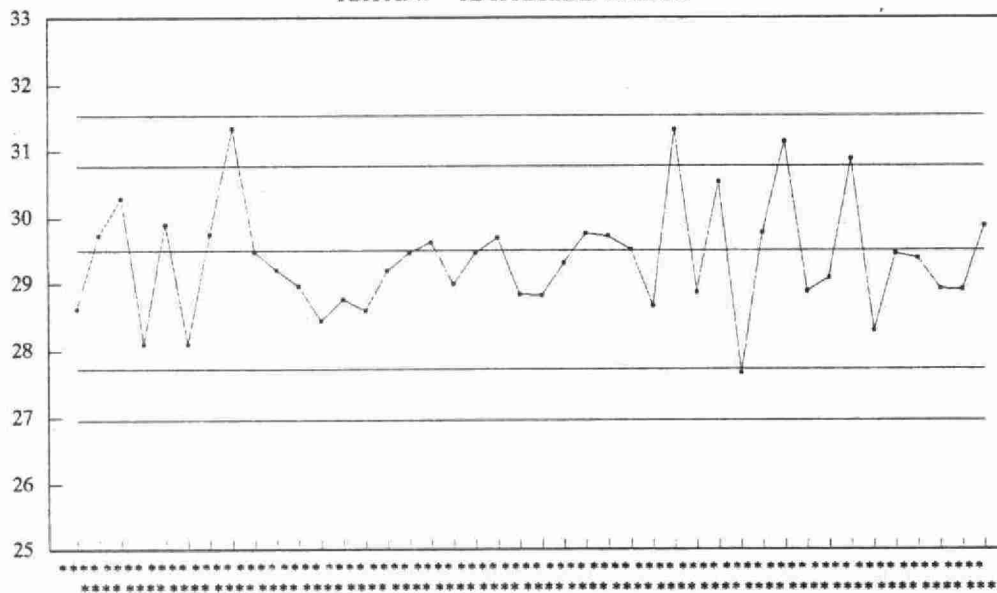


Jan. 01, 1992 - Dec. 31, 1992
Runs: 5004 - 7566

QCA+QCB

ASUT ARSENIC, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS



Jan. 01, 1992 - Dec. 31, 1992
Runs: 5004 - 7566

QCA-QCB

SELENIUM (TOTAL) – SEUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.2 – 40 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCA:	33	40.000	39.358	98.4	4.1
QCB:	33	10.000	10.432	104.3	3.9
QCA+QCB:	33	50.000	49.790	99.6	3.3
QCA–QCB:	33	30.000	28.926	96.4	5.6

For 1993 Control Limits:

$$Sw (A-B) = 1.6256$$

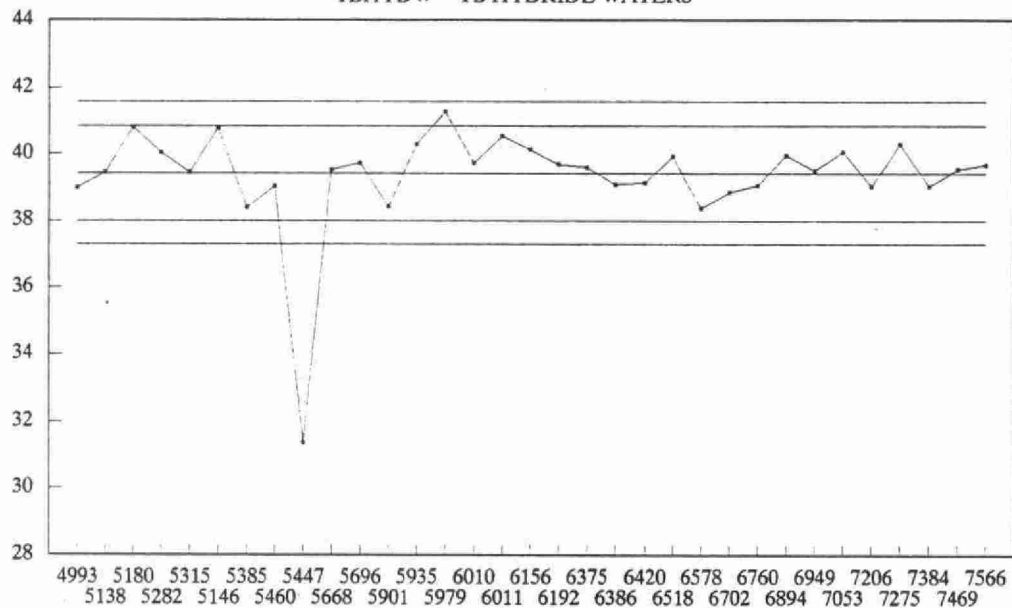
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
112	0.2	8	0.31	0.1000
0	8	20	–	–
0	20	40	–	–

Detection Limit (DL) = 0.2 ug/L

SEUT SELENIUM, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

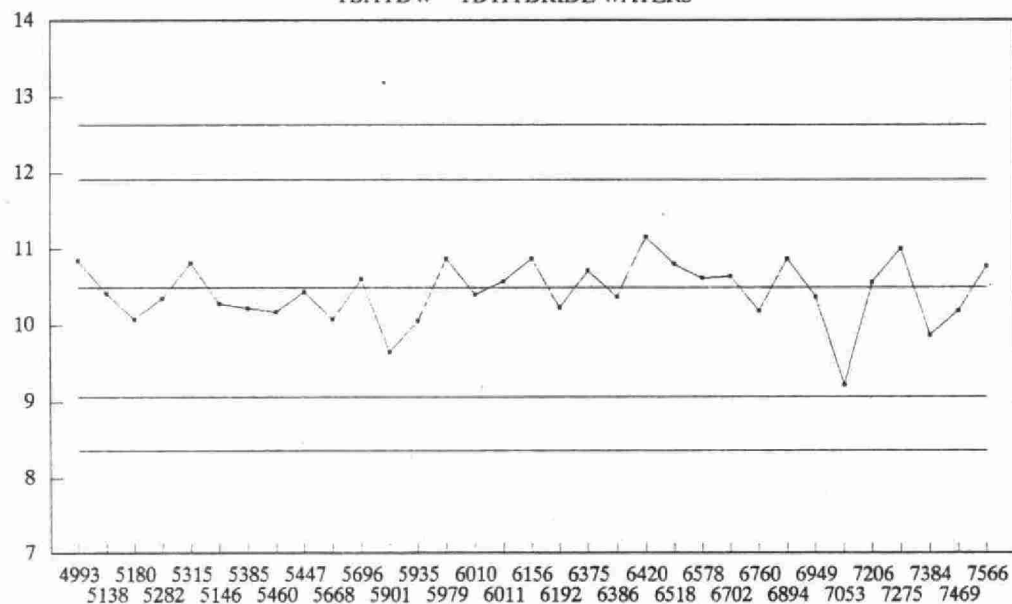


→ QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566

SEUT SELENIUM, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

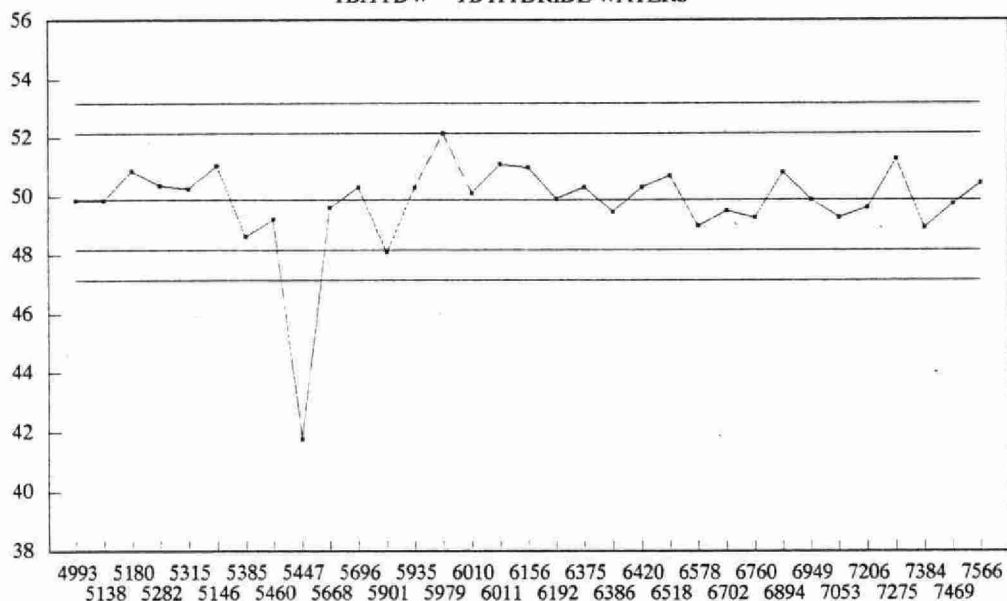


→ QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566

SEUT SELENIUM, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

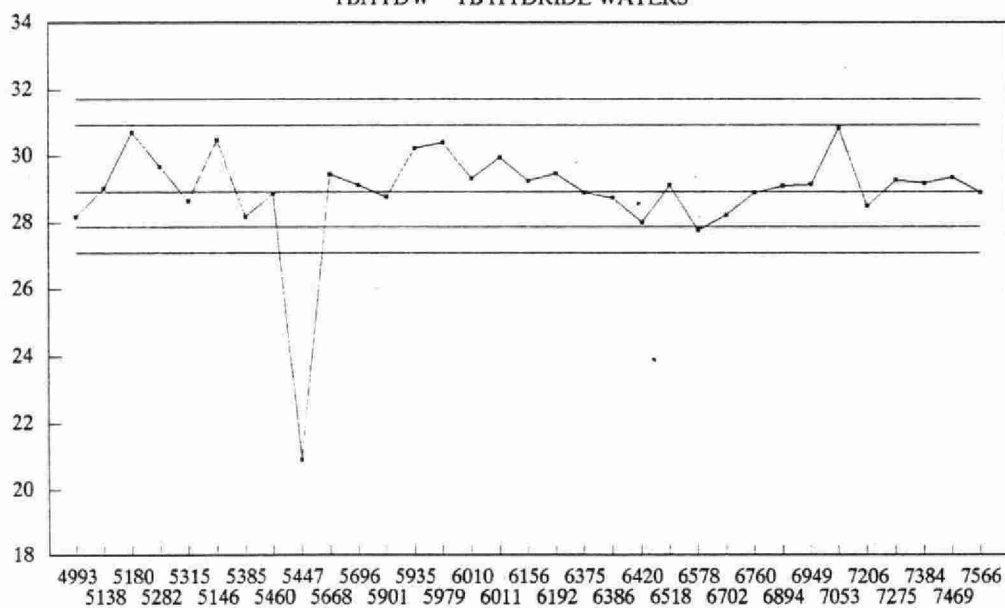


— QCA+QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 4993 – 7566

SEUT SELENIUM, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS



— QCA-QCB

Jan. 01, 1992 – Dec. 31, 1992
Runs: 4993 – 7566

ANTIMONY (TOTAL) – SBUT

Quality Control Data from January 1 to December 31, 1992

Analytical Range: 0.2 – 40 ug/L

Control Samples:

	Number of Data	Target Conc.	Avg. Conc. Measured	% Recovery	% Rel. Std. Dev.
QCA:	27	40.000	39.865	99.7	3.2
QCB:	27	10.000	9.630	96.3	3.6
QCA+QCB:	27	50.000	49.495	99.0	2.5
QCA-QCB:	27	30.000	30.230	100.8	4.6

For 1993 Control Limits:

$$Sw (A-B) = 1.383$$

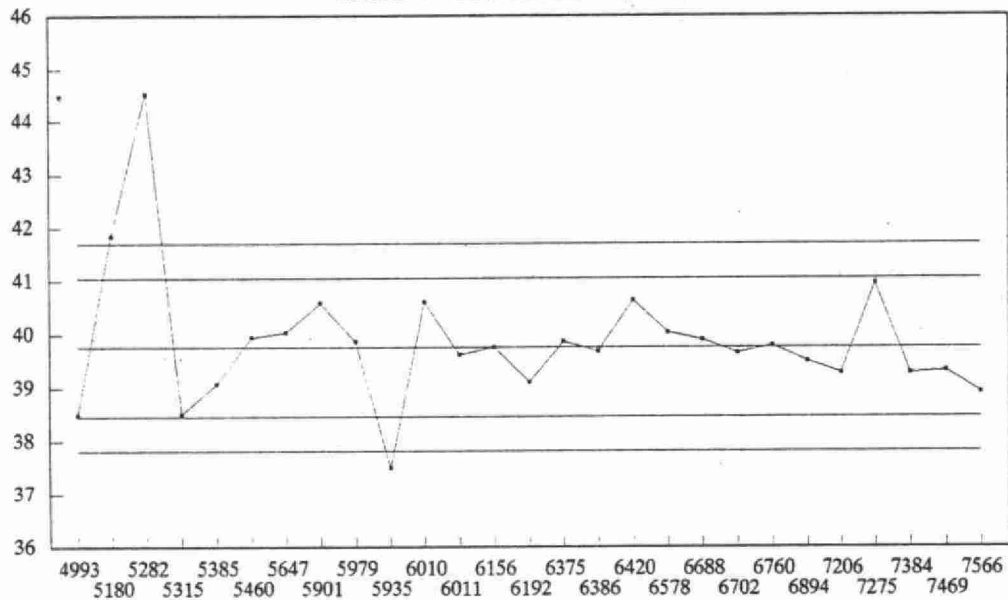
Duplicates:

Number of Data Pairs	Sample Conc Span		Mean Value	Standard Deviation
	FROM	TO		
86	0.2	8.0	0.70	0.1500
1	8.0	20.0	9.5	—
0	20.0	40.0	—	—

$$\text{Detection Limit (DL)} = 0.2 \text{ ug/L}$$

SBUT ANTIMONY, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

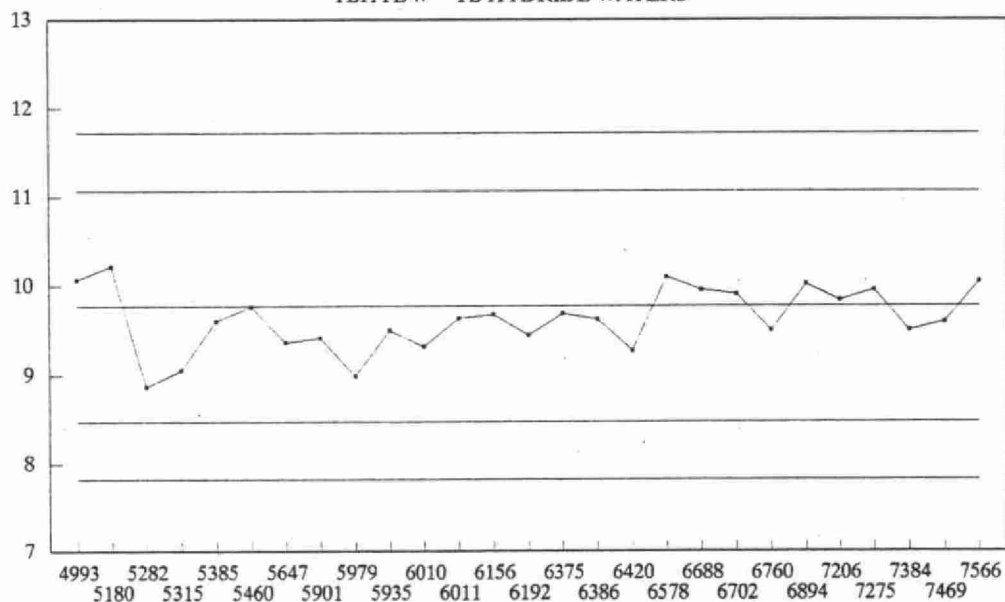


QCA

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566

SBUT ANTIMONY, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS

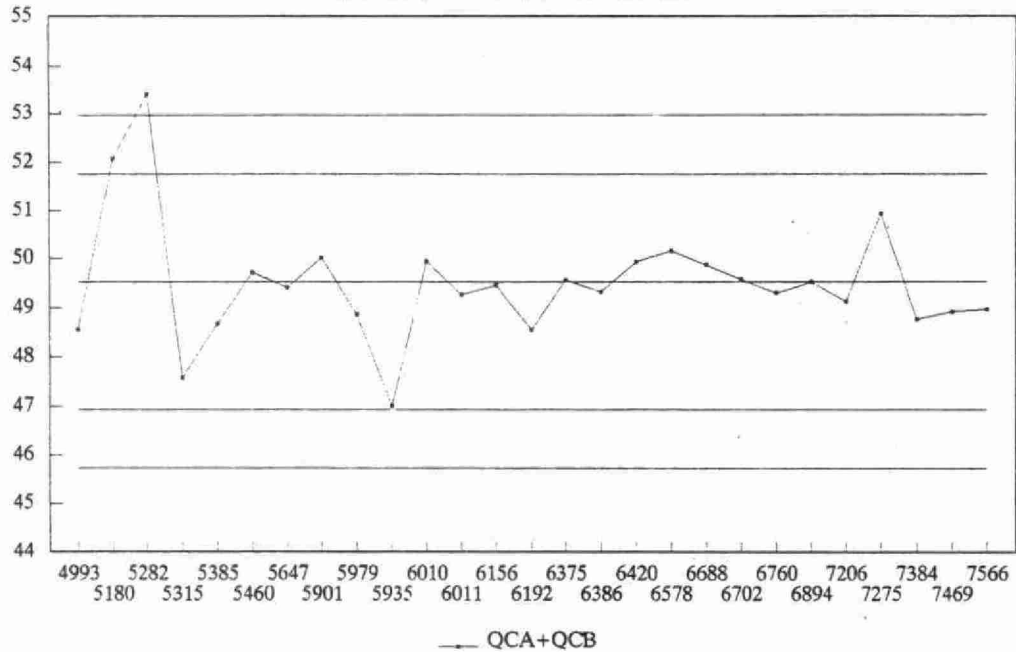


QCB

Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566

SBUT ANTIMONY, UNF. TOTAL

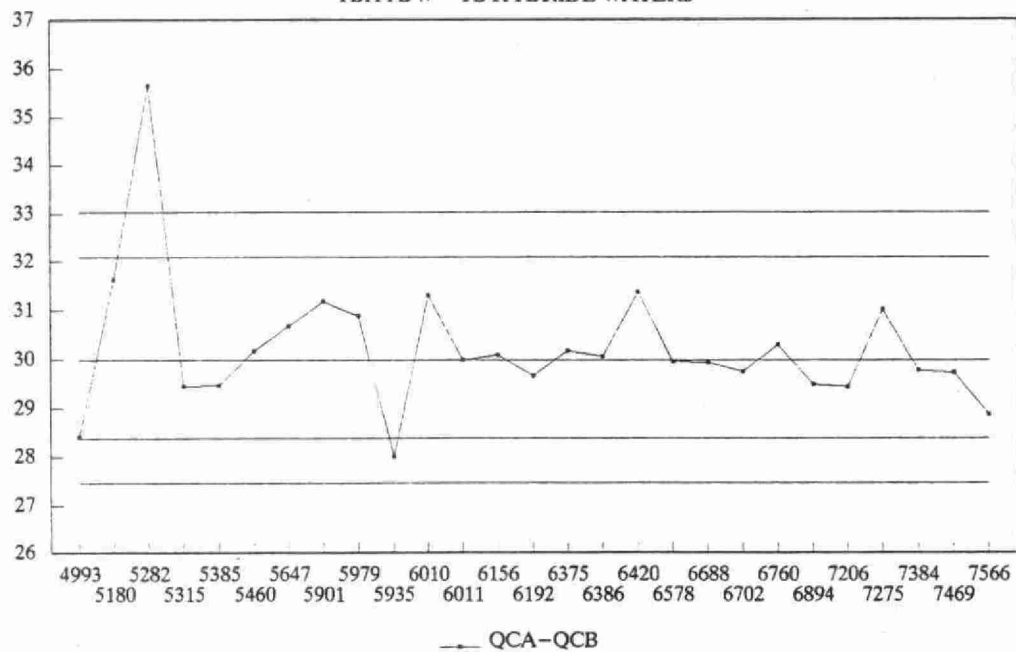
TBHYDW TB HYDRIDE WATERS



Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566

SBUT ANTIMONY, UNF. TOTAL

TBHYDW TB HYDRIDE WATERS



Jan. 01, 1992 - Dec. 31, 1992
Runs: 4993 - 7566



(8468)

TD/380/T86/1992/MOE